Chowgule Education Society's
Parvatibai Chowgule College of Arts and Science
(Autonomous)
Accredited by NAAC with Grade 'A+'
Best Affiliated College-Goa University Silver Jubilee Year Award
1962-2022

26/04/2023

To
All the members of the BOS- Computer Science

Subject: Minutes of the meeting of the 13th Board of Studies in Computer Science held on 24th April 2023

Sir/Madam,

I am forwarding the minutes of the meeting of 13th Board of Studies in Computer Science held on 24th April 2023. If no exception is taken by any member who was present at the meeting to the correctness of the Minutes of the Meeting within 3 days of dispatch of the Minutes, they shall be deemed to be correct.

Yours faithfully,

Mr. V.C Kumaresh
Chairperson
BOS- Computer Science

Encl: 1. Minutes of Meeting

2. Approved list of courses and syllabus

P.O. Fatorda, Gogol-Margao, Goa 403602, Phone:0832-2722222, Fax: 0832 2759067, Email: principal@chowgules.ac.in

MINUTES OF MEETING OF THE BOARD OF STUDIES IN COMPUTER SCIENCE
HELD ON 24th APRIL, 2023 at
Parvatibai Chowgule College of Arts & Science
(Autonomous)
Margao – Goa

With Chowgule College notice F.133(C)/116, dated 12th April, 2023, a meeting of this BOS was convened on 24th April, 2023 at 2:00 p.m. through offline mode, at Parvatibai Chowgule College of Arts & Science, Margao – Goa. Since the number of members present represented the Quorum, the BOS began its proceedings.

Members present:

1. Mr. Kumaresh V.C. – Chairperson (In the absence of Chairperson Dr. Sameena S. Falleiro)
2. Dr. Kusum Gauns Dessai- Academic Council Nominee
3. Mr. Vinay Praveen Mahale – Alumni Representative
4. Mr. D. Prabakaran- Member
5. Mr. Alberto Ian Barreto -Member
6. Mrs. Judith Dias Barreto – Member
7. Ms. Suchitra Bhat - Member
8. Ms. Subweta Foodekar – Member Secretary
9. Mr. Mithesh Matha- Member
10. Mr. Tejaswi Nial - Member
11. Mr. Milindra Alve - Member

Member Absent with Intimation

1. Dr. Bharat Sinha -Academic Council Nominee
2. Dr. D.K. Lakshminarayana – Vice Chancellor, Goa University Nominee
3. Mr. Jervis Pereira – Industry Representative
4. Dr. Sameena S. Falleiro
5. Dr. Shaila R. Ghanti -Member
6. Mr. Anagh Raiturkar- Member
7. Mrs. Sanna Shaikh - Member
8. Ms. Vidya Nadagaddi- Member

Proceedings

The Chairperson welcomed the members of the Board of Studies (BOS). The Chairperson introduced and explained the agenda for the meeting and read out the minutes of the previous B.O.S meet. The meeting continued taking up the following agenda.

Agenda Items:

1. To appraise the course structure as per the UGC guidelines for UG programmes based on NEP 2020.
2. To approve the list of courses under the nomenclatures: Core (Major & Minor), Skill enhancement course, Value added course, Multidisciplinary course & Ability enhancement course whichever is applicable.
3. To approve syllabi of semester I & II courses under new course structure for BSc Computer Science.
4. To approve syllabi of MSc IT under new course structure.
5. To approve and review syllabi of B.Voc.
6. AOB.

PART A:

1. To appraise the course structure as per the UGC guidelines for UG programmes based on NEP 2020.

Course Structure approved by the Governing Body was appraised by the Chairperson to the BoS members.

The BOS passed the resolutions as follows:

2. To approve the list of courses under the nomenclatures: Core (Major & Minor), Skill enhancement course, Value added course, Multidisciplinary course & Ability enhancement course whichever is applicable.

The list of courses with codes as per UGC guidelines was presented by the Member Secretary. After discussion, it was suggested to include SCILAB as one of the SEC courses in Semester III.

After discussion, the members approved the same with suggestions.

3. To approve syllabi of semester I & II courses under new course structure for BSc Computer Science.

The syllabi of semester I & II courses were presented by the Member Secretary. The members suggested the following:

1. To remove topic "Install and configure R software and R Studio and Getting help" from Unit 1 (Programming with R: UG-COM-SEC 1)

2. To include Cyber Forensics as a topic under Cyber Crime and Cyber law (VAC- Cyber Security- Unit 1

After discussion, the members approved the same with suggestions.

4. To approve syllabi of MSc IT under new course structure.

The syllabi of MSc IT was presented by the Coordinator. The members suggested the following:

1. The levels of the list of courses included in Generic Electives should be atleast 400. Accordingly changes to be made and get approved in the next BOS.
2. To remove the list of NPTEL/SWAYAM courses from the Course Structure.

After discussion the members approved the same with suggestions.

5. To approve and review syllabi of B.Voc.

The syllabi of B.Voc. was presented by the Coordinator and after discussion the members approved the same.

6. AOB.

The Chairperson mentioned that Students from the Mathematics department would like to opt for Data Science course offered in the 6th semester during the Academic Year 2023-24. It was suggested by the BoS members that the Students have to take Python Programming (if not done earlier) as an extra credit course in 5th Semester, and opt for Data Science course in 6th Semester as an extra credit.

After discussion, the members approved the same with suggestions.

PART B: Important Points/ recommendations of BOS that require consideration / approval of Academic Council:

1. Appraise the course structure as per the UGC guidelines for UG programmes based on NEP 2020 presented in Annexure A.
2. Approval of the list of courses under the nomenclatures: Core (Major & Minor), Skill enhancement course, Value added course, Multidisciplinary course presented in Annexure A.
3. Approval of syllabi of semester I & II courses under new course structure for BSc Computer Science in Annexure B.
4. Approval of syllabi of MSc IT under new course structure presented in Annexure C.
5. Approval of the revised syllabi of B.Voc. presented in Annexure D.

After fruitful interaction and deliberation, a vote of thanks was given by Ms. Ashweta Fondekar, Member Secretary.

Members present:

1. Mr. Kumaresh V.C. – Chairperson (In the absence of Chairperson Dr. Sameena S. Falleiro)
2. Dr. Kissan Gauns Dessai- Academic Council Nominee
3. Mr Vinay Praveen Mahale – Alumni Representative
4. Mr. D. Prabakaran- Member
5. Mr. Alberto Ian Barreto -Member
6. Mrs. Judith Dias Barreto – Member
7. Ms. Suchitra Bhat - Member
8. Ms. Ashweta Fondekar – Member Secretary
9. Mr. Mahesh Matha- Member
10. Mr. Gajanan Nial - Member
11. Mr. Mitendra Alve - Member

Member Absent with Intimation

1. Dr. Sharad Sinha -Academic Council Nominee
2. Dr. J.A. Lakshminarayana – Vice Chancellor, Goa University Nominee
3. Mr. Jervis Pereira – Industry Representative
4. Dr. Sameena S. Falleiro
5. Dr. Shaila R. Ghanti -Member
6. Mr. Amogh Raiturkar- Member
7. Mrs. Sanas Shaikh - Member
8. Ms.Vidya Nadagaddi- Member

Ms. Ashweta Fondekar
Member Secretary
BOS (Computer Science)

Mr. V.C. Kumaresh
Chairperson
BOS (Computer Science)

Date: 28/4/2023

P.O. Fatorda, Gogol-Margao, Goa 403602, Phone:0832-2722222, Fax: 0832 2759067, Email: principal@chowgules.ac.in

PART C: The remarks of the Dean of the Faculty:-

a. The minutes are in order.

b. The minutes may be placed before the Academic Council with remarks, if any.

c. Important points of the minutes which need clear policy decision of the Academic Council to be recorded.

Date: 27 April 2023

Signature of the Dean:
(Faculty of Science)

Dr. Meghana Devli

PART D: The remarks of the Members Secretary of the Academic Council:-

a. The minutes are in order.
b. The minutes may be placed before the Academic Council with remarks ,if any.
c. Important points of the minutes which need clear policy decision of the Academic Council to be recorded.

Date: 28/4/23

Signature of the Member Secretary
Academic Council

Mr. V.C. Kumaresh
(Vice Principal)

Annexure B

Parvatibai Chowgule College of Arts and Science
(Autonomous)

Accredited by NAAC with Grade 'A+'
Best Affiliated College-Goa University Silver Jubilee Year Award

DEPARTMENT OF COMPUTER SCIENCE

SYLLABUS FOR THREE/FOUR YEAR UNDERGRADUATE DEGREE HONOURS

PROGRAMME IN B.Sc. COMPUTER SCIENCE
(Implemented from the Academic Year 2023-2024 onwards)

COURSE STRUCTURE

SEMESTER	MAJOR CORE	MINOR/ VOCATIONAL	MULTI-DISCIPLINARY COURSE (MDC)	VALUE ADDED COURSES (VAC)	SKILL ENHANCEMENT COURSE (SEC)	INTERNSHIP
I	**UG-COM-101:** Introduction to Programming	**UG-COM-101:** Introduction to Programming	**UG-COM-MDC1:** Office Automation **UG-COM-MDC2:** Introduction to Python Programming	**UG-COM-VAC1:** Cyber Security	**UG-COM-SEC1:** Programming with R	
II	**UG-COM-102:** Database Management Systems	**UG-COM-102:** Database Management Systems	**UG-COM-MDC2:** Introduction to Python Programming	**UG-COM-VAC1:** Cyber Security	**UG-COM-SEC2:** Programming In Python	

			UG-COM-MDC3: Introduction to R Programming			
III	**UG-COM-201:** Data Structures	**UG-COM-201:** Data Structures	**UG-COM-MDC4:** Fundamentals of Data Science		**UG-COM-SEC3:** UI/UX Design	
	UG-COM-202: Object Oriented Programming					
IV	**UG-COM-203:** Computer Architecture	**UG-COM-VOC-1:** Web Design				
	UG-COM-204: Operating System					
	UG-COM-205: Mobile Application Development					
	UG-COM-206: Software Engineering					
V	**UG-COM-301:** Full Stack Development	**UG-COM-VOC-2:** Digital Marketing				**UG-COM-INT:** Internship
	UG-COM-302: IOT					
	UG-COM-303: Computer Networks					
VI	**UG-COM-304:**	**UG-COM-VOC-3:**				

	Data Science	Software Testing				
	UG-COM-305 : Cloud Computing					
	UG-COM-306 : AI					
	UG-COM-PRJ Project					
VII	**UG-COM-401 :** Design and Analysis of Algorithms	**UG-COM-405:** Image Processing				
	UG-COM-402 : Software Architecture, Design Patterns and Frameworks					
	UG-COM-403 : Advanced DBMS					
	UG-COM-404 : Machine Learning					
VIII	**UG-COM-406 :** Compiler Design	**UG-COM-410:** Network Security				
	UG-COM-407 : Deep Learning					
	UG-COM-408 : NLP					
	UG-COM-409 : Educational Technology					

SEMESTER I

DISCIPLINE SPECIFIC CORE COURSE

Course Title: Introduction to Programming
Course Code: UG-COM-101
Marks: 75
Credits: 3
Duration: 45 Hrs
Prerequisites courses: Nil

Course Objectives :

- To understand the concept of basic computer algorithm and flowchart and use the algorithm for various problem solving.
- To implement algorithms using a high level programming language.
- To understand basic principles of structured programming – example C.

Course Learning Outcome: Upon completion of the course students will be able to:

CLO1: Explain problem solving strategies.
CLO2: Draw a flowchart for a given problem.
CLO3: Write an algorithm for a given problem.
CLO4: Explain and Apply sorting and searching algorithms.
CLO5: Recognize and incorporate programming elements such as loops, decision making, functions, arrays, strings.
CLO6: Recognize and incorporate programming elements such as structures, pointers and files into applications that solve real world problems.

SYLLABUS

UNIT I **[10 HRS]**

Introduction to Computer Problem Solving: Algorithm, Flowchart, The Problem-Solving Aspect, General problem-solving strategies, Top-Down Design, Implementation of Algorithms, Efficiency of Algorithms, Recursive algorithms.

Basic Algorithms: Exchanging the values, Summation of a set of numbers, factorial computation, generation of the Fibonacci series, reversing the digits of an integer, base conversion.

Factoring Methods: Finding divisors of an integer, finding the Greatest Common Divisor of two integers, generating prime numbers, computing prime factors of an integers.

Sorting and Searching: Bubble sort, Insertion Sort, Sequential Search and Binary Search

UNIT II **[20 HRS]**

C Language: History, Structure of a C program, Keywords, Identifiers, variables, constants, data types, Arithmetic Operators & Expressions, Logical operators and Relational Operators, Precedence and Associativity rules.

Conditions and Iterations: Conditions and Actions, Condition statement, Simple control statement (if, if-else,switch), Iterative control statements (for, while, do-while).

Functions: What is a function, Advantages of functions, Standard library functions; User define functions – declaration, definition, function call, parameter passing, return keyword. Scope of variables, Storage classes, Recursion.

Arrays: One- and Two-dimensional arrays: Array declaration, initialization, accessing the values, passing arrays to functions.

Pointers: Pointer declaration, initialization, Pointer arithmetic, Pointer to Pointer, Arrays and Pointers, Functions and Pointers – passing pointers to functions, function returning pointer, dynamic memory allocation.

UNIT III **[15 HRS]**

Strings: Declaration and initialization, standard library string functions, strings and pointers, array of strings.

Structure and Union: Creating structures, accessing structure members, array of structures, passing structure to functions, nested structure, pointers and structures, union, difference between structures and unions.

File Handling: FILE variable, file access modes, operations on files, random access to files, command line arguments.

Pre-processing: Format of Preprocessor directive, File Inclusion directive, Macro substitution, conditional compilation.

REFERENCES:

MANDATORY:

1. Dromey, R. G. (1982). How to Solve it by Computer. Prentice-Hall, Inc..
2. Kanetkar,Y. (2012). Let us C, BPB Publications,
3. Forouzan, B. A., & Gilberg, R. F. (2000). Computer Science: A structured programming approach

using C. Brooks/Cole Publishing Company..

SUPPLEMENTARY:

1. Horowith,E.,Sahni ,S.,Sanguthevar,R. (2008). Fundamentals of Computer algorithm, Orient Longman.
2. Gottfried,B. (2010). Programming with C, Tata McGraw Hill.

WED BASED:

1. GNU GCC (GNU Compiler Collection) @http://gcc.gnu.org, with source codes.
2. Bjarne Stroustrup's C++11 FAQ @http://www.stroustrup.com/C++11FAQ.html.
3. https://www.tutorialspoint.com/cprogramming
4. https://www.javatpoint.com/c-programming-language-tutorial
5. https://www.w3schools.in/c-tutorial/
6. https://www.guru99.com/c-programming-tutorial.html
7. https://www.geeksforgeeks.org/c-programming-language/
8. E Book - https://www.edutechlearners.com/download/books/Let%20Us%20C%20by%20Yashavant%20Kanetkar%20PDF.pdf
9. E Book - http://www2.cs.uregina.ca/~hilder/cs833/Other%20Reference%20Materials/The%20C%20Programming%20Language.pdf
10. E Book - http://www.kciti.edu/wp-content/uploads/2017/07/cprogramming_tutorial.pdf

Practical: Introduction to Programming
Credit: 1
Marks: 25
Duration: 30 Hrs

Programs using C language that covers the following concepts:

1. Conditions
   - if..else
   - nested if

2. Iterative Control Statements
   - for
   - while
   - do…while

3. Functions.
   - Standard Library functions
   - Call by Value
   - Call by reference
   - Recursive functions

4. Arrays.
   - One Dimensional Arrays
   - Two Dimensional Arrays

5. Sorting
   - Bubble sort
   - Insertion sort

6. Searching.
   - Sequential search
   - Binary search

7. Pointers.
   - Arrays and Pointers
   - Function returning pointers
   - Dynamic memory allocation

8. Strings.
   - Standard Library string functions
   - Strings and Pointers
   - Array of Strings

9. Structure and Union
   - Array of structures
   - Passing Structure to functions
   - Nested structure
   - Structure and Pointer
   - Union

10. File Handling.
    - Text file
    - Binary file
    - Random Access to a file
    - Command Line arguments

MULTIDISCIPLINARY COURSES (MDC)

Following are the list of MDCs*:

Course Title: Office Automation
Course Code: UG-COM-MDC1

Course Title: Introduction to Python Programming
Course Code: UG-COM-MDC2

Course Title: E-Learning
Course Code: UG-COM-MDC3

Course Title: Introduction to R Programming
Course Code: UG-COM-MDC4

Course Title: Multimedia
Course Code: UG-COM-MDC5

* The syllabus of all the five courses have been approved by BOS. However, for semester I and II, minimum two MDCS will be offered.

Course Title: Office Automation
Course Code : UG-COM-MDC1
Marks: 50
Credits: 2
Duration: 30 Hrs

Prerequisites Course:
Nil

Course Objectives:
- To explore the features of a few automation tools used in office work.
- Study and implement the features of spreadsheets, and Image/Graphic design tools.

Course Learning Outcomes:
At the end of the course students will be able to:

CLO1: Understand basic Spreadsheet features.
CLO2: Work with different worksheets.
CLO3: Analyze the data using various graphs.
CLO4: Analyze data using various spreadsheet features such as lookup tables, Pivot tables, and other statistical features.

CLO5: Use different features of DTP software.
CLO6: Develop a desktop Publishing Application using given software.

SYLLABUS

UNIT I

Spreadsheets: **[8 HRS]**

Spread Sheet & its Applications, Spreadsheet addressing - Rows, Columns & Cells, Referring Cells & Selecting Cells – Shortcut Keys. Entering & Deleting Data- Entering data filling. Find, Search & replace, Inserting Data, Insert Cells, Column, rows & sheets, Symbols, Data from external files, Frames, Clipart, Pictures, Files etc, Inserting Functions, Manual breaks, Setting Formula - finding total in a column or row.
Mathematical operations: (Addition, Subtraction, Multiplication, Division, Exponentiation), Using other Formulae. Formatting Spreadsheets, Sorting, Filtering, Validation, Consolidation, and Subtotal. Using Tools – Error checking, Spell Checks, Formula Auditing, Creating & Using Templates, Pivot Tables, Tracking Changes, Security, Customization.

Presentation Software and Graphics editor – GIMP [10 HRS]

Introduction & area of use; Creating a New Presentation; Working with Presentation; Using Wizards; Slides & it's different views; Inserting, Deleting and Copying of Slides; Working with Notes, Handouts, Columns & Lists; Adding Graphics, Sounds and Movies to a Slide; Working with Objects; Designing & Presentation of a Slide Show; Printing Presentations, Notes, Handouts with print options.

Graphics editor – GIMP : Introduction, Introducing the Workspace, Learning all the primary Tools: Working with Layers, Colors, Filters , Dealing with text and Fonts. Basics of Photo editing.

UNIT II

Inkscape: - Vector Graphics design: - [12 HRS]

Introduction: Introduction to Inkscape, Features of Inkscape, Inkscape Interface, learning about Raster and Vector Graphics.
Basic Drawing Skills: Selecting and Manipulating Objects, Drawing and Shaping Objects, Arranging Objects.
Mastering Different Tools: Using Text and Color, layers, groups, align and distribute, transformation tools.
Applying Special Effects: Learning Blending modes, Distortion, Contour Effects on text, Envelope effect, Clip image. tracing image with different modes.
Saving, Exporting and printing: Different Saving options, exporting your designs into different formats for printing, Creating layouts and finalizing content for printing.

REFERENCES:

MANDATORY:

1. Mark Moore, (2015), Mastering Excel: Building Dashboards, (1stEd.), CreateSpace Independent Publishing Platform.

2. Dinesh Maidasani, (2008), Straight to the Point – MS Office 2003, (1st Ed.), Firewall Publications.

SUPPLEMENTARY:

1. Ramesh Bangia, (2017), Learning PageMaker 7, (Ed), Khanna Book Publishing Co Pvt Ltd.
2. Michael S. Toot, (2017), Master Visually Microsoft Office 2003, (Ed), Visual Publishers.
3. Mansfield, (2017), Mastering WORD 6 for Windows, (Ed), BPB
4. Townsend, (2017), Mastering EXCEL 4 for Windows, (Ed), BPB

WEB BASED:

1. https://www.guru99.com/excel-tutorials.html
2. https://www.gimp.org
3. https://www.gimp.org/tutorials
4. https://www.javatpoint.com/gimp
5. https://inkscape.org
6. 'https://inkscape.org/learn/tutorials

Practicals: Office Automation
Credit: 01
Marks: 25
Duration: 30 Hours

List of practical :

Spreadsheet and Presentation Software (4P)
Using formulas and functions:
To prepare a Worksheet showing the monthly sales of a company in different branch, offices (Showing Total Sales, Average Sales).Prepare a Statement for preparing Result of 10 students in 5 subjects (using formula to get Distinction, I Class, II Class and Fail under Result column against each student).

Operating on the sheets:
Finding, deleting and adding records, formatting columns, row height, merging, splitting columns etc. Connecting the Worksheets and enter the data.

Creating a Chart:
To create a chart for comparing the monthly sales of a company in different branch offices.

Using the data consolidate command:

1. To use the data consolidate command to calculate the total amount budgeted for all departments (wages, travel and entertainment, office supplies and so on) or to calculate the average amount budgeted for – say, department office expenses.
2. Sorting Data, Filtering Data and creation of Pivot tables.

3. Working on presentation (any open source presentation software such as impress or equivalent).

GIMP and Inkscape (11 P)

1. Introduction to GIMP workspace.
2. Basic Drawing Skills and using the tools of GIMP.
3. Removing the background and water mark of the image using GIMP.
4. Editing the image using GIMP tools.
5. Introduction to Inkscape tools with properties.
6. Designing the posters on different themes - Inkscape
7. Adding special effects
8. Creating a logo (Vector graphics design)
9. Advanced effects
10. Trace image with different modes.
11. Use gradient tool to create realistic images.

Course Title: Introduction to Python Programming
Course Code: UG-COM-MDC2
Marks: 50
Credits: 2
Duration: 30 Hrs
Pre-requisite courses : Nil

Course Objectives :

- To understand the concept of basic computer algorithm and flowchart and use the algorithm for various problem solving.
- To implement algorithms using programming language.
- To provide skills of data analysis using Python programming language.

Course Learning Outcome: Upon completion of the course students will be able to

CLO1: Write an algorithm and draw flowchart for a given problem.
CLO2: Understand the basics (Operations, Control structures, data types,etc).
CLO3: Write programs using conditional statements, loops.
CLO4: Apply required List,Tuple and dictionary function.
CLO5: Write Python program specific to the domain of the given problem.
CLO6: Create applications using python programming.

SYLLABUS

UNIT I **[15 HRS]**

1. Basics of Python Programming: Features of Python, Applications of Python,writing and executing Python Program.
2. Introduction to Problem Solving Strategies, Program Design tools: Algorithms, flowcharts. Basic Algorithms: Exchanging the values, Summation of a set of numbers, factorial computation, generation of the Fibonacci series, reversing the digits of an integer, base conversion.
3. Basic Syntax: Variable and Data Types, Operator, Conditional Statements - if, if- else, Nested if-else. Looping – For, While, Nested loops. Control Statements – Break, Continue, Pass
4. Strings: Accessing Strings, Basic Operations, String slices, Function and methods.
5. Tuple and Lists: Introduction, accessing list, Operations, Working with lists, Function and Methods. Introduction Accessing tuples, Operations, Working, Functions and Methods.

UNIT II **[15 HRS]**

1. Dictionaries: Introduction, accessing values in dictionaries, Working with dictionaries, Properties.
2. Functions: Defining a function, Calling a function, Types of functions, Function arguments, Anonymous functions, global and local variables.
3. Module: Importing module. Math module. Random Module.
4. Input-Output: Printing on screen, Reading data from keyboard, Opening and closing file, Reading and writing files, Functions. Printing on screen, reading data from keyboard, Opening and closing file, Reading and writing files, Functions.

REFERENCES:

MANDATORY:

1. Dromey, R. G. (1982). How to Solve it by Computer. Prentice-Hall,
2. Inc.. Mark Lutz,Learning Python, O'Reilly Media, Fifth Edition.

SUPPLEMENTARY:

1. Reema Thareja (2020), Python Programming Using problem solving approach, Oxford Higher Education
2. Horowith ,E.,Sahni ,S.,Sanguthevar,R. (2008). Fundamentals of Computer algorithm, Orient Longman.
3. Alex Martelli, (2006)Python – A Nutshell, O'Reilly Media, Second Edition. Wes McKinney, (2012)Python for Data Analysis, O'Reilly Media.

WEB BASED:

1. https://www.w3schools.com
2. https://www.tutorialspoint.com

3. https://www.javatpoint.com
4. https://www.geeksforgeeks.org
5. https://www.guru99.com

Practicals: Introduction to Python Programming
Credit: 01
Marks: 25
Duration:30 Hrs

List of Experiments using Python Language:

1. Write a python program to compute a given formula. [1P]
2. Write a python program to implement an if else statement. [1P]
3. Write a python program to implement nested if else statements. [1P]
4. Implement for and while loop in python. [2P]
5. Write a string manipulation in python. [2P]
6. Write a program to implement lists in python. [2P]
7. Write a python program to implement tuple. [1P]
8. Write a python program to implement a dictionary. [2P]
9. Write python program to implement function [1P]
10. Write a python program to implement Input-Output File Operations in python. [2P]

Course Title: E-Learning
Course Code: UG-COM-MDC3
Marks: 50
Credits: 2
Duration: 30 Hrs

Pre-requisite courses : Nil

Course Objectives:

1. To understand the basic concept of ICT (Information Communications Technology) in education.
2. To understand the basic concept of Instructional Design principles.
3. To develop E-content in various application areas related to ICT and Education.

Course Learning Outcomes:

On completion of this course the student will be able to:

CLO1: Explain the working of an E-learning module.

CLO2: Develop E-Content using the Instructional Design Process and upload on LMS.

CLO3: Evaluate and apply appropriate E-Learning Strategy to a given topic.

CLO4: Differentiate between Summative and Formative assessment.

SYLLABUS

UNIT I: Introduction and Course Development [15 HRS]

1. Scope and form of E-learning, Role of an E-learning project Phases in E-learning project. Instructional Design: The process of Designing Instruction.
2. Developing Materials (Storyboarding, Content Integration, and SCORM Compliance). Working with L.M.S. (Learning Management System)- Installation and use of the administrator, teacher and student interface; Course Definition, Registration and upload, tracking of results.

UNIT II: E-learning Strategies & Assessment Design [15 HRS]

1. E-Learning Strategies: Simulation, Drill, Interactive Learning, Problem Solving, Tutorials.
2. Assessment: Online formative and summative assessment. Rubrics for Assessment-Analytic and Holistic Rubrics, Security and Authentication.

REFERENCES:

MANDATORY:

Shelly Cashman Gunter.(2011).Teachers Discovering Computers: Integrating Technology in the Classroom,(7th ed.).Wadsworth Publishing Co Inc.

SUPPLEMENTARY:

1. Smith, P. L. & Ragan, T. J.(2008). Instructional design(4rth ed.). New York: John Wiley & Sons. ISBN:0471393533
2. M.D. Roblyer, Aaron H. Doering(2018). Integrating Educational Technology into Teaching: Student Value Edition (8th ed.). Publisher: Pearson ISBN-10: 013289680X, ISBN-13:978- 0132896801.
3. Dick, W., Carey, L., & Carey, J. O.(2014). The systematic design of instruction (8th ed.). Boston

WEB BASED:

1.https://www.udemy.com/course/instructional-design-for-elearning/

2.https://nptel.ac.in/courses/127101013/

3.https://nptel.ac.in/courses/121105010/

4. https://www.plesyoutube.com/watchv=0flnAoX9QEw

5.https://nptel.ac.in/content/storage2/nptel_data3/html/mhrd/ict/text/121106012/lec13.pdf

Practicals: **Elearning**

Credit : 1

Marks : 25

Duration: 30 Hrs

Suggested list of practical (Numbers in brackets indicate examples of Free Open-Source ICT Tools that are available and the number of practicals)

1. Construct a Mind Map (Free Mind/Mindomo) - (1 P)
2. Create a Storyboard (PPT/Movie Maker/PowToon's/Storyboardthat) -(2 P)
3. Screen Recording S/W(Screencast/OBS/Filmora) - (2 P)
4. Collaborative Tools (G Suite) - (1 P)
5. Creating Blogs-(Blogger/Word Press) - (2 P)
6. Installation, Creation & Running of an LMS- (Moodle/Google Classroom - (1 P) 7. Uploading Resources & Activities in the LMS-(Moodle/ Google Classroom - (2 P)
8. Creating a Complete Course in the LMS- (2 P)
9. Design Rubrics for Scenarios-(Hot Potatoes/Ed puzzle/Poll Everywhere) - (2 P)

Course Title: Introduction to R Programming

Course Code: UG-COM-MDC4
Marks: 50

Credits: 2
Duration:30 Hrs.

Prerequisite Courses : Nil

Course Objectives:

- To make the student understand the fundamentals of R language.
- To implement algorithms using R.
- To connect R with other data sources and perform computation
- To use R for plotting charts and graphs

Course Learning Outcomes:

At the end of the course students will be able to :

CLO1 : Develop solutions to problems and implement these solutions in R.

CLO2 : Use R with various data sources and perform computation.

CLO3 : Solve mathematical problems using R.

CLO4 : Plot charts and graphs using R.

SYLLABUS

UNIT I **[15 Hrs]**

Introduction to R:
R console to perform basic arithmetic operations, display strings and workspace variables, R Overview.

R Data Types:
Determining the data type of a variable, boolean, integer, numeric, character, complex and raw. Vectors, Lists, Matrices, Data Frames, Factors and Arrays

R Operators:
Arithmetic Operators, Relational Operators, Logical Operators, Assignment Operators Miscellaneous Operators (Colon, %in% and %*%)

Control Flow and Iterations:
The if, if-else, if – else if-else and switch statements, while and for loops, loops for vectors, matrices, data frames and lists. Programs to test understanding of the same.

UNIT II **[15 Hrs]**

Functions in R:
Writing an R function, Nested Functions, Function Scoping, Recursion, Loading an R package, Mathematical Functions, Cumulative sums and products, Calculus, Input and Output operations, Selection and Bubble sort, Linear and Binary Search.

R Data Interfaces: R and Database Connectivity , creating and dropping tables, inserting data and updating table rows, querying and querying with filters.
R and CSV files – Inputting, Reading, Writing to and Analyzing csv files.
R and Spreadsheets – Reading from, writing to and analyzing spreadsheets
R and XML files – Reading and processing XML files.

Charts and Graphs : Generating Pie charts, Bar Charts and Line Graph.

REFERENCES:

MANDATORY:

1. K. G. Srinivasa, G. M. Siddesh et al, Statistical Programming in R, Oxford University Press.

SUPPLEMENTARY:

1. Sandip Rakshit, R Programming for Beginners, McGraw Hill Education.
2. Tilman M. Davies,The Book for R, No Starch Press.
3. Emmanuel Paradis, R Programming for Beginners.

WEB BASED:

1. https://www.tutorialspoint.com/r/index.htm

2. https://www.javatpoint.com/r-tutorial
3. https://www.w3schools.com/r/
4. https://www.programiz.com/r
5. https://intellipaat.com/blog/tutorial/r-programming/

Practicals: Introduction to R Programming
Credit:1
Marks:25
Duration:30 Hrs

1. R-Programming Basics: Installing R Studio, Using R console to perform basic arithmetic operations, display strings and workspace variables. [1P]
2. Data types in R. [1P]
3. Data Structures: Vectors, Lists, Matrices, Data Frames, Factors and Arrays[3P]
4. Operators in R.[1P]
5. Control Flow and Iterations.[3P]
6. Functions in R.[2P]
7. R Data Interfaces: R and Database Connectivity ,creating and dropping tables, inserting data and updating table rows, querying and querying with filters.[2P]
8. Charts and Graphs : Generating Pie charts, Bar Charts and Line Graph.[2P]

SKILL ENHANCEMENT COURSE (SEC)

Course Title:Programming with R
Course Code: UG-COM-SEC1
Marks: 50
Credits: 2
Duration: 30 Hrs.
Prerequisite Courses : Nil

Course Objectives:

- To make the student understand the fundamentals of R language.
- To implement algorithms using R.
- To connect R with other data sources and perform computation
- To use R for plotting charts and graphs

Course Learning Outcomes:

At the end of the course students will be able to :

CLO1 : Develop solutions to problems and implement these solutions in R.

CLO2 : Use R with various data sources and perform computation.

CLO3 : Solve mathematical problems using R.

CLO4 : Plot charts and graphs using R.

SYLLABUS

UNIT I **[15 Hrs]**

Introduction to R:
R console to perform basic arithmetic operations, display strings and workspace variables, R Overview.
R Data Types:
Determining the data type of a variable, boolean, integer, numeric, character, complex and raw. Vectors, Lists, Matrices, Data Frames, Factors and Arrays
R Operators:
Arithmetic Operators, Relational Operators, Logical Operators, Assignment Operators Miscellaneous Operators (Colon, %in% and %*%)
Control Flow and Iterations:
The if, if-else, if – else if-else and switch statements, while and for loops, loops for vectors, matrices, data frames and lists. Programs to test understanding of the same.

UNIT II **[15 Hrs]**

Functions in R:
Writing an R function, Nested Functions, Function Scoping, Recursion, Loading an R package, Mathematical Functions, Cumulative sums and products, Calculus, Input and Output operations, Selection and Bubble sort, Linear and Binary Search.
R Data Interfaces: R and Database Connectivity , creating and dropping tables, inserting data and updating table rows, querying and querying with filters.
R and CSV files – Inputting, Reading, Writing to and Analyzing csv files.
R and Spreadsheets – Reading from, writing to and analyzing spreadsheets
R and XML files – Reading and processing XML files
Charts and Graphs : Generating Pie charts, Bar Charts and Line Graph.

REFERENCES:

MANDATORY:

1. K. G. Srinivasa, G. M. Siddesh et al, Statistical Programming in R, Oxford University Press.

SUPPLEMENTARY:
1. Sandip Rakshit, R Programming for Beginners, McGraw Hill Education.
2. Tilman M. Davies,The Book for R, No Starch Press.
3. Emmanuel Paradis, R Programming for Beginners.

WEB BASED:
1. https://www.tutorialspoint.com/r/index.htm
2. https://www.javatpoint.com/r-tutorial
3. https://www.w3schools.com/r/
4. https://www.programiz.com/r
5. https://intellipaat.com/blog/tutorial/r-programming/

Practicals: Programming with R
Credit:1
Marks:25
Duration:30 Hrs

1. R-Programming Basics: Installing R Studio, Using R console to perform basic arithmetic operations, display strings and workspace variables. [1P]
2. Data types in R. [1P]
3. Data Structures: Vectors, Lists, Matrices, Data Frames, Factors and Arrays[3P]
4. Operators in R.[1P]
5. Control Flow and Iterations.[3P]
6. Functions in R.[2P]
7. R Data Interfaces: R and Database Connectivity ,creating and dropping tables, inserting data and updating table rows, querying and querying with filters.[2P]
8. Charts and Graphs : Generating Pie charts, Bar Charts and Line Graph.[2P]

VALUE ADDED COURSES (VAC)

Course Title: Cyber Security

Course Code : UG-COM-VAC1
Marks: 50
Credits : 2
Duration : 30 Hrs

Course Objectives:

- Learn the foundations of Cyber security
- Equip students with the technical knowledge and skills needed to protect and defend against cyber threats.
- Develop skills in students that can help them to ensure the protection of information technology assets.
- Expose students to responsible use of online social media networks.

Course Learning Outcomes:

Upon completion of the course students will be able to:

CLO1: Understand the cyber security threat landscape.
CLO2: Understand cyber laws
CLO3 : Develop a deeper understanding and familiarity with various types of cyber attacks cyber crimes, vulnerabilities and remedies thereto
CLO4 : Analyse and evaluate the digital payment system security and remedial measures against digital payment frauds.

SYLLABUS

UNIT I **[15 HRS]**

Introduction to Cyber Security :Defining Cyberspace and Overview of Computer and Web-technology, Architecture of cyberspace, Communication and web technology, Internet, World wide web, Advent of internet, Internet infrastructure for data transfer and governance, Internet society, Regulation of cyberspace, Concept of cyber security, Issues and challenges of cyber security.

Cyber Crime and Cyber Law : Classification of cyber crimes, Common cyber crimes- cyber crime targeting computers and mobiles, cyber crime against women and children, financial frauds, social engineering attacks, malware and ransomware attacks, zero day and zero click attacks, Cyber criminals modus-operandi , Reporting of cyber crimes, Remedial and mitigation measures,

Legal perspective of cyber crime, IT Act 2000 and its amendments, Cyber crime and offenses, Organizations dealing with Cyber crime and Cyber security in India, Case studies, Cyber Forensics.

Unit II : [15 Hrs]

Social Media Overview and Security

Introduction to Social networks. Types of Social media, Social media platforms, Social media monitoring, Hashtag, Viral content, Social media marketing, Social media privacy, Challenges, opportunities and pitfalls in online social network, Security issues related to social media, Flagging and reporting of inappropriate content, Best practices for the use of Social media, Case Studies.

E - C o m m e r c e and Digital Payments

Definition of E- Commerce, Main components of E-Commerce, Elements of E-Commerce security, E-Commerce threats, E-Commerce security best practices, Introduction to digital payments, Components of digital payment and stake holders, Modes of digital payments- Banking Cards, Unified Payment Interface (UPI), e-Wallets, Unstructured Supplementary Service Data (USSD), Aadhar enabled payments, Digital payments related common frauds and preventive measures. RBI guidelines on digital payments and customer protection in unauthorized banking transactions. Relevant provisions of Payment Settlement Act,2007.

Digital Devices Security , Tools and Technologies for Cyber Security :

End Point device and Mobile phone security, Password policy, Security patch management, Data backup, Downloading and management of third party software, Device security policy, Cyber Security best practices, Significance of host firewall and Ant-virus, Management of host firewall and Anti-virus, Configuration of basic security policy and permissions.

Suggested activities :

1. Setting, configuring and managing three password policy in the computer (BIOS, Administrator and Standard User).
2. Setting and configuring two factor authentication in the Mobile phone.
3. Security patch management and updates in Computer and Mobiles.
4. Managing Application permissions in Mobile phone.
5. Installation and configuration of computer Anti-virus.
6. Installation and configuration of Computer Host Firewall

REFERENCES:

MANDATORY:

1. Cyber Crime Impact in the New Millennium, by R. C Mishra , Auther Press. Edition 2010.
2. Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by Sumit Belapure and Nina Godbole, Wiley India Pvt. Ltd. (First Edition, 2011)

SUPPLEMENTARY:

1. Security in the Digital Age: Social Media Security Threats and Vulnerabilities by Henry A. Oliver, Create Space Independent Publishing Platform. (Pearson , 13th November, 2001)
2. Electronic Commerce by Elias M. Awad, Prentice Hall of India Pvt Ltd.
   Cyber Laws: Intellectual Property & E-Commerce Security by Kumar K, Dominant Publishers.
3. Network Security Bible, Eric Cole, Ronald Krutz, James W. Conley, 2nd Edition, Wiley India Pvt. Ltd.
4. Fundamentals of Network Security by E. Maiwald, McGraw Hill.

SEMESTER II

DISCIPLINE SPECIFIC CORE COURSE

Course Title: Data Base Management Systems
Course Code : UG-COM-102
Marks: 75
Credits:3
Duration: 45 Hrs

Course Prerequisites: Nil

Course Objectives:

- To provide basic knowledge of a database management system.
- To understand importance of Entity Relationship diagram.
- To formulate queries in Relational Algebra and SQL for Database manipulation.
- Familiarity with any RDBMS during practical sessions.

Course learning outcomes:
Upon completion of the course students will be able to:

CLO1: Explain the various concepts of database system.
CLO2: Design ER-models to represent simple database application scenarios.
CLO3: Convert an ER diagram to a database schema.
CLO4: Formulate queries in Relational Algebra, and SQL to manipulate the database.
CLO5: Analyze the schema to see if they fulfill Normalization criterion.

SYLLABUS

UNIT I: Overview of DBMS, Design and ER model. [15 HRS]

Overview of database management : Data, information, database, database management system; Managing data; File systems versus a DBMS, advantages of a DBMS; Data abstraction, instances and schemas, data models; Data manipulation language, data definition language; Architecture of a DBMS; Users of a DBMS, database administrator.

Database design and the ER model: Design phases – conceptual design, logical design, physical design; ER model – entities, attributes, and relationships, mapping cardinalities, keys; ER diagrams – strong entities, weak entities, generalization, specialization, aggregation; Converting ER diagram to relational schemes.

Unit II : Functional dependency and normalization [10 HRS]

Atomic domain, nested relation; Key, super key, primary key, candidate key; Functional dependency, axioms, closure of a set of attributes, closure of a set of functional dependencies; Purpose of normalization; 1NF; 2NF;3NF; BCNF.

UNIT III : Relational model and SQL [20 HRS]

Relational model: Relation, properties of relational model; Entities, integrity constraints, referential integrity constraints; Relational algebra – select, project, cross product, set operations, rename operation; Other relational operations – natural join, outer join.

SQL: Basic structure of SQL query – Create, select, where, from, rename operation; Set operations; Aggregate functions; Group by, having clauses; DDL Nested queries; Views; Insert, delete, update.

REFERENCES

MANDATORY:

1. Silberschatz, A. (2006). Database system concepts.—6th ed.

SUPPLEMENTARY:

1. Ramakrishnan, R., & Gehrke, J. (2000). Database management systems. McGraw Hill.
2. Elmasri, R., & Navathe, S. (2017). Fundamentals of database systems. Pearson.

WEB BASED:

1. https://www.db-book.com/db6/slide-dir/ (Sixth edition Powerpoint , PDF of A Silberschatz, H F Korth, S Sudarshan, Database system concepts,)
2. https://www.db-book.com/db7/
3. https://www.tutorialspoint.com › dbms
4. https://www.w3schools.in › dbms
5. https://www.studytonight.com › dbms
6. https://www.oracletutorial.com

Practical: Database Management Systems **Credit :1** **Marks :25** **Duration: 30 Hrs**	
1. ER diagram	(2P)
2.ER diagram with specialization/generalization and aggregation.	(1P)
3. Converting ERD into Schema.	(2P)
4 SQL	(2P)
5 Nested Queries	(2P)
6.Normalization	(2P)
7. Mini Project	(4P)

SKILL ENHANCEMENT COURSE (SEC)

Course Title: Programming in Python

Course Code: UG-COM-SEC2

Marks: 50

Credits: 2

Duration: 30 HRS

Course prerequisite:

Introduction to Programming (UG-COM-101)

Course Objectives:

- To apply various data types and control structures.
- To apply python data structures - list, tuple and dictionary.
- To structure a python program as a set of functions.
- To do input/output with files in Python.
- To provide skills of data analysis using Python programming language.

Course Learning Outcomes:

At the end of the course students should be able to :

CLO1: Understand syntax of Python Programming.
CLO2: Write a program using conditional statements, loops.
CLO3: Apply required List,Tuple and Dictionary function.
CLO4: Write Python program specific to the domain of the given problem.

CLO5: Create applications using python programming.

SYLLABUS

UNIT I **[15 HRS]**
Motivation, programming paradigms, What Python can do, Python's technical strength, Python interpreter, Program execution, Execution model variations, How to run programs.

Basic Syntax :
Variable and Data Types, Operator, Conditional Statements - if, if- else, Nested if-else. Looping – For, While, Nested loops. Control Statements – Break, Continue, Pass.

Strings :
Accessing Strings, Basic Operations, String slices, Function and Methods.

Tuples and Lists :
Introduction, Accessing list, Operations, Working with lists, Function and Methods.
Introduction Accessing tuples, Operations, Working, Functions and Methods.

UNIT II **[15 HRS]**

Dictionaries:
Introduction, Accessing values in dictionaries, Working with dictionaries, Properties.

Functions:
Defining a function, Calling a function, Types of functions, Function Arguments, Anonymous functions, Global and local variables.

Modules:
Importing module. Math module. Random Module.

Exception Handling:
Exception. Exception Handling - Except clause, Try , except, finally clause. User Defined Exceptions.

Input-Output :
Printing on screen, Reading data from keyboard, Opening and closing file, Reading and writing files, Functions.

REFERENCES:

MANDATORY:

1. Mark Lutz,Learning Python, O'Reilly Media, Fifth Edition.

SUPPLEMENTARY:

1. Alex Martelli, (2006)Python – A Nutshell, O'Reilly Media, Second Edition.
2. Wes McKinney, (2012)Python for Data Analysis, O'Reilly Media.

WEB BASED:

1. https://www.w3schools.com
2. https://www.tutorialspoint.com
3. https://www.javatpoint.com
4. https://www.geeksforgeeks.org
5. https://www.guru99.com

Practicals: Programming in Python

Credit: 01

Marks: 25

Duration:30 Hrs

List of Experiments using Python Language:

1. Write a python program to compute a given formula. [1P]
2. Write a python program to implement an if else statement. [1P]
3. Write a python program to implement nested if else statements. [1P]
4. Implement for and while loop in python. [2P]
5. Write a string manipulation in python. [2P]
6. Write a program to implement lists in python. [2P]
7. Write a python program to implement tuple. [1P]
8. Write a python program to implement a dictionary. [2P]
9. Write python program to implement function [1P]
10. Write a python program to implement Input-Output File Operations in python. [2P]

VALUE ADDED COURSES (VAC)

Course Title: Cyber Security

Course Code : UG-COM-VAC1
Marks: 50
Credits : 2
Duration : 30 Hrs

Course Objectives:

- Learn the foundations of Cyber security
- Equip students with the technical knowledge and skills needed to protect and defend against cyber threats.
- Develop skills in students that can help them to ensure the protection of information technology assets.
- Expose students to responsible use of online social media networks.

Course Learning Outcomes:

Upon completion of the course students will be able to:

CLO1: Understand the cyber security threat landscape.
CLO2: Understand cyber laws
CLO3 : Develop a deeper understanding and familiarity with various types of cyber attacks cyber crimes, vulnerabilities and remedies thereto
CLO4 : Analyse and evaluate the digital payment system security and remedial measures against digital payment frauds.

SYLLABUS

UNIT I **[15HRS]**

Introduction to Cyber Security :Defining Cyberspace and Overview of Computer and Web-technology, Architecture of cyberspace, Communication and web technology, Internet, World wide web, Advent of internet, Internet infrastructure for data transfer and governance, Internet society, Regulation of cyberspace, Concept of cyber security, Issues and challenges of cyber security.

Cyber Crime and Cyber Law : Classification of cyber crimes, Common cyber crimes- cyber crime targeting computers and mobiles, cyber crime against women and children, financial frauds, social engineering attacks, malware and ransomware attacks, zero day and zero click attacks, Cybercriminals modus-operandi ,Reporting of cyber crimes, Remedial and mitigation measures, Legal perspective of cyber crime, IT Act 2000 and its amendments, Cyber crime and offences, Organisations dealing with Cyber crime and Cyber security in India, Case studies, Cyber Forensic.

Unit II : [15 Hrs]

Social Media Overview and Security

Introduction to Social networks. Types of Social media, Social media platforms,Social media monitoring, Hashtag, Viral content, Social media marketing, Social media privacy, Challenges, opportunities and pitfalls in online social network, Security issues related to social media, Flagging and reporting of inappropriate content, Best practices for the use of Social media, Case Studies.

E - C o m m e r c e and Digital Payments

Definition of E- Commerce, Main components of E-Commerce, Elements of E-Commerce security, E-Commerce threats, E-Commerce security best practices, Introduction to digital payments, Components of digital payment and stake holders, Modes of digital payments- Banking Cards, Unified Payment Interface (UPI), e-Wallets, Unstructured Supplementary Service Data (USSD), Aadhar enabled payments, Digital payments related common frauds and preventive measures. RBI guidelines on digital payments and customer protection in unauthorized banking transactions. Relevant provisions of Payment Settlement Act,2007.

Digital Devices Security , Tools and Technologies for Cyber Security :

End Point device and Mobile phone security, Password policy, Security patch management, Data backup, Downloading and management of third party software, Device security policy, Cyber Security best practices, Significance of host firewall and Ant-virus, Management of host firewall and Anti-virus, Configuration of basic security policy and permissions.

Suggested activities :

1.Setting, configuring and managing three password policy in the computer (BIOS, Administrator and Standard User).
2. Setting and configuring two factor authentication in the Mobile phone.
3. Security patch management and updates in Computer and Mobiles.
4. Managing Application permissions in Mobile phone.
5. Installation and configuration of computer Anti-virus.
6. Installation and configuration of Computer Host Firewall

REFERENCES:

MANDATORY:

1. Cyber Crime Impact in the New Millennium, by R. C Mishra , Auther Press. Edition 2010.
2. Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by Sumit Belapure and Nina Godbole, Wiley India Pvt. Ltd. (First Edition, 2011)

SUPPLEMENTARY:

1. Security in the Digital Age: Social Media Security Threats and Vulnerabilities by Henry A. Oliver, Create Space Independent Publishing Platform. (Pearson , 13th November, 2001)
2. Electronic Commerce by Elias M. Awad, Prentice Hall of India Pvt Ltd.
   Cyber Laws: Intellectual Property & E-Commerce Security by Kumar K, Dominant Publishers.
3. Network Security Bible, Eric Cole, Ronald Krutz, James W. Conley, 2nd Edition,Wiley India Pvt. Ltd.
4. Fundamentals of Network Security by E. Maiwald, McGraw Hill.

Annexure C

M.Sc [Information Technology]
COURSE STRUCTURE
(2023-2024)

Semester I (20 credits)

Course Code	**Course Type**	**Course Title**	**Credits**	**Contact hours/week**	
				L	**P**
PGPM-IT-DSC-401	DSC	Advanced Data Structures and Algorithms	4	4	0
PGPM-IT-DSC-402	DSC	Operating Systems and Networks	4	4	0
PGPM-IT-DSC-403	DSC	Machine Learning	4	4	0
PGPM-IT-DSC-404	DSC	Advanced Data Structures and Algorithms Lab	2	0	4
PGPM-IT-DSC-405	DSC	Operating Systems and Networks Lab	2	0	4
	Total Credits for Discipline Core subjects		**16**		
	DSE	Discipline Specific Elective I	4	4	0
	Total Minimum Credits for Discipline Elective subjects		**4**		
	List of Discipline Specific Elective I:				
PGPM-IT-DSE-401	Cloud Computing		4	4	0
PGPM-IT-DSE-402	Software Quality Assurance and Testing		4	4	0
PGPM-IT-DSE-403	Computer Graphics		4	4	0
PGPM-IT-DSE-404	Compiler Design		4	4	0

Semester II (20 credits)

Course Code	**Course Type**	**Course Title**	**Credits**	**Contact hours/week**	
				L	**P**
PGPM-IT-DSC-406	DSC	Design and Analysis of Algorithms	4	4	0
PGPM-IT-DSC-407	DSC	Advanced Database Management Systems	4	4	0
PGPM-IT-DSC-408	DSC	Software Architecture, Design Patterns andFrameworks	2	2	0
PGPM-IT-DSC-409	DSC	Design and Analysis of Algorithms Lab	2	0	4

PGPM-IT-DSC-410	DSC	Advanced Database Management System Lab	2	0	4
PGPM-IT-DSC-411	DSC	Software Architecture, Design Patterns and Frameworks Lab	2	0	4
	Total Credits for Discipline Specific Core subjects		**16**		
	DSE	Discipline Specific Elective II	4	2	4
	Total Credits for Discipline Specific Elective subjects		**4**		
	List of Discipline Specific Elective II: (2 Theory + 2 Practical)				
PGPM-IT-DSE-405	Web Development Frameworks		4 (2T+2P)	2	4
PGPM-IT-DSE-406	Mobile Application Development		4 (2T+2P)	2	4
PGPM-IT-DSE-407	Agile Methodology and DevOps		4 (2T+2P)	2	4
PGPM-IT-DSE-408	Cryptography and Network Security		4 (2T+2P)	2	4

Semester III (24 credits)

Course Code	**Course Type**	**Course Title**	**Credits**	**Contact hours/week**	
				L	**P**
	DSE	Discipline Specific Elective III	4	4	0
	DSE	Discipline Specific Elective IV	4	4	0
	Total Minimum Credits for Discipline Specific Elective subjects		**8**		
	DSRE	Research Specific Elective-I	6 (4T+2P)	4	4
	DSRE	Research Specific Elective-II	6 (4T+2P)	4	4
	Total Minimum Credits for Discipline Specific Research Elective subjects		**12**		
	GE	Generic Elective I	4	4	0
	Total Minimum Credits for Generic Elective subjects		**4**		

	List of Discipline Specific Electives III & IV:			
		Credits	**L**	**P**
PGPM-IT-DSE-501	Data Mining	4	4	0
PGPM-IT-DSE-502	Information Retrieval	4	4	0
PGPM-IT-DSE-503	Information Security	4	4	0
PGPM-IT-DSE-504	Parallel and Distributed Computing	4	4	0
PGPM-IT-DSE-505	Soft Computing	4	4	0
PGPM-IT-DSE-506	Digital Image Processing	4	4	0
	List of Discipline Specific Research Electives I & II			
PGPM-IT-DSRE-501	Research Methodology	6 (4T+2P)	4	4
PGPM-IT-DSRE-502	Data Analytics	6 (4T+2P)	4	4
PGPM-IT-DSRE-503	Modeling and Simulation	6 (4T+2P)	4	4
PGPM-IT-DSRE-504	Blockchain Technologies	6 (4T+2P)	4	4
PGPM-IT-DSRE-505	Natural Language Processing	6 (4T+2P)	4	4
PGPM-IT-DSRE-506	Neural Networks and Deep Learning	6 (4T+2P)	4	4
PGPM-IT-DSRE-507	Educational Technology	6 (4T+2P)	4	4
	List of Generic Electives for Students of other PG Programmes			
PGPM-IT-GE-501	Programming using Python	4	4	0
PGPM-IT-GE-502	Introduction to Web Designing	4	4	0
PGPM-IT-GE-502	Content Management System	4	4	0

Semester IV(16 Credits)

Course Code	**Course Type**	**Course Title**	**Credits**	**Contact hours/week**	
				L	**P**
PGPM-IT-DSI-501	Internship	Industrial Internship	16	0	0
PGPM-IT-DSR-501	Dissertation	Research Project in Academic or Research Institutes	16	0	0

(Summary of changes incorporated in the syllabus)

Semester	Course Title	Existing (Indicate only the unit where the change is proposed)	Changes Proposed	Specify the reason for the change
I	Advanced Data Structures and Algorithms	Unit II	Added: Maximum Flow	Duration changed from 48 to 60 hrs. In addition to the existing graph algorithms one more is included
I	Advanced Data Structures and Algorithms	Unit III	Added: Counting Sort	In addition to the existence of sorting algorithms one more is included.
I	Advanced Data Structures and Algorithms Lab	List of Practicals Sr N0 2	Added: Implementation of Binary Tree and its Traversal	Duration changed from 48 to 60 hrs. New experiments accommodated
I	Advanced Data Structures and Algorithms Lab	List of Practicals Sr No 5	Added: Implementation of Heap Structure	Duration changed from 48 to 60 hrs. New experiments accommodated
I	Operating Systems and Networks	Unit I	Introduction to Processes, Process states, Process Control Block, Process Scheduling Queues, Short-term, Long-term and Medium-term schedulers, Context Switch Introduction to threads, Benefits of	Students joining MSc IT from BCA background lack depth in the subjects of Operating Systems and Networks. To bridge the gap, advanced topics related to Process Control, Threads,

			multithreaded programming, User and Kernel threads, Multithreading models Basic concepts of CPU Scheduling, Scheduling criteria, Scheduling Algorithms Cooperating processes and Race Conditions, The critical-section problem, Peterson's solution, mutex locks, Synchronization Hardware, Semaphores and their Implementation, Classic problems of synchronization. System Model, Deadlock characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock	Synchronization and Deadlocks need to be discussed in detail
I	Operating Systems and Networks	Unit II, III and IV	Memory Management background**,** Swapping , Contiguous Memory Allocation, Paging, Segmentation Introduction to Virtual-Memory, Demand Paging,	Added OS concepts like File Management and memory management topics to Unit II. Rearranged the contents of Networks in Units III and IV.

			Process creation, Page replacement, Allocation of frames, Thrashing File Concept, Access Methods, Directory Structure, File-system mounting, File sharing, Protection.	
I	Operating Systems and Networks Lab	NA	Added Linux File System, File & Directory Management and Filters	To introduce the students to intricacies of Linux.
II	Design and Analysis of Algorithms	Unit III	Added: KMP Algorithms	Duration changed from 48 to 60 hrs. More examples of Text processing algorithms introduced
II	Advanced Database Management Systems	Unit III	Added: Database Security: Types of Security, Threats, Control Measures, SQL Injection, its risks and Protection techniques	Duration changed from 48 to 60 hrs. Elaboration of important topic like Database security introduced
II	Design and Analysis of Algorithms Lab	List of Practicals Sr No 7	Added: Implementation of Text Processing Algorithms: Rabin-Karp and KMP	Duration changed from 48 to 60 hrs. More experiments of Text processing algorithms introduced
II	Advanced Database Management Systems Lab	List of Practicals Sr No 9	Added: Installation and Introduction to GraphStore : Neo4j	Duration changed from 48 to 60 hrs. New experiment introduced
II	Software Architecture,	Unit II	Added to Unit II:	This course was reduced to 2

	Design Patterns and Frameworks		Software Architecture & its importance, System Quality attributes discernible at runtime, Business Qualities, Architecture Qualities, Data Flow Architecture, Virtual machine Architecture, Call & Return Architecture, Independent Component Architecture. MVC & Broker, Component and Deployment Diagrams.	units from 4 units. So certain concepts of the earlier Unit III had to be distributed in Unit II.

SYLLABUS

DISCIPLINE SPECIFIC CORE (DSC) COURSES

Course Title: Advanced Data Structures and Algorithms
Course Code: PGPM-IT-DSC-401
Credits: 4
Marks: 100
Duration: 60 Hrs

Course Prerequisites:
Familiarity with basic data structures like Stacks, Queues, Linked Lists and Binary Trees.

Course Objectives:
The objective of the course is to understand the real-life applications of data structures and be familiar with writing recursive and iterative methods using data structures.

Course Learning Outcomes:
At the end of the course students will be able to:

CLO1: Design an algorithm for the use case.
CLO2: Choose efficient data structures and apply them to solve problems.
CLO3: Design and analyze the time and space efficiency of the data structure.
CLO4: Formulate new solutions for programing problems or improve existing code using learned algorithms and data structures,

Syllabus:

Unit I: [15 Hrs]
Overview of Linear Data Structures
ADT, Sparse matrices, Linked Lists: Doubly linked list, Circular linked list, Doubly Circular linked lists, Operations on Linked Lists. Stack and Queues: Need and justification of the study, Multiple stacks and queues, Dequeues, Circular Queues, Priority Queues, Implementation of recursion using stack, Application of stacks, queues and linked lists.

Unit II: [15 Hrs]
Non Linear Data Structures
Trees: Definitions, terminologies and properties, Binary tree representation and traversals , Skewed Trees, Binary Search Trees: AVL Trees, Red Black Tree, suffix trees, Segment Tree, Splay trees ,M-way Search Trees, B-trees, B+-trees.
Graphs: Definitions, terminologies and properties, Graph representations: Graph Traversals , Maximum Flow, Eulerian Graphs , Hamiltonian Graphs. Heap Structures.

Unit III: [15 Hrs]
Complexity of Sorting and Searching Algorithms

Mathematical Background, Big-O notation and computational Analysis of functions, Running Time computation, Radix Sort, Heap Sort, Quick Sort, Merge Sort ,Insertion Sort, Shell Sort, Counting Sort, Interpolation search, Symbol Tables.

Unit IV: [15 Hrs]

File Organization and Processing

Dynamic memory management. Sequential files, Hashing techniques: Approaches to collision problem, Indexed sequential files: organization, Creation, Update and Maintenance, Multi-key files,Inverted file, Multi-list file, Tries: Standard Tries, Compressed Tries, Suffix Tries, Huffman Algorithm.

REFERENCES:

Mandatory:

1. R. Venkatesan , S. Lovelyn Rose (2019) "Data structures" (2nd Ed) Wiley.
2. Prof Peter Brass (2014) "AdvancedData Structures ",(1st Ed), Cambridge University Press.

Supplementary:

1. Alfred V. Aho, John E Hoproft, Jeffrey D. Ullman, "Data structures and algorithms",(2nd Ed) Pearson Education India Delhi,
2. Jean-Paul Tremblay, Paul Sorenson (2017), An Introduction to Data Structures with Application, (2 nd Ed), McGraw Hill Education.

Web References:

1: http://www.cs.cmu.edu/~ab/15-121N11/
2: https://www.cse.iitb.ac.in/~ranade/cs213/
3: http://cse.iitrpr.ac.in/ckn/courses/f2015/csl201/w4.pdf
4: https://www.cpp.edu/~ftang/courses/CS241/notes/b-tree.html
5: https://www.cs.usfca.edu/~galles/visualization/Algorithms.html

Course Title:Operating Systems and Networks
Course Code: PGPM-IT-DSC-402
Credits:4
Marks: 100
Duration: 60 Hrs

Course Prerequisites:

● Basics of Operating Systems and Networks

Course Objectives:
● To understand Real time operating systems
● To gain understanding in specific areas of networking such as the design and maintenance of individual networks.

Course Learning Outcomes:

At the end of the course students will be able to:

CLO1: Understand file system structure, processes, threads and memory management.
CLO2: Analyse various resource management and fault tolerance techniques for real time systems.
CLO3: Discuss the fundamentals of IP addressing.
CLO4: Apply subnet masking concepts to allocate space for host in subnet.

Syllabus:

Unit I: [20 Hrs]

Introduction to Processes, Process states, Process Control Block, Process Scheduling Queues, Short-term, Long-term and Medium-term schedulers, Context Switch

Introduction to threads, Benefits of multithreaded programming, User and Kernel threads, Multithreading models

Basic concepts of CPU Scheduling, Scheduling criteria, Scheduling Algorithms

Cooperating processes and Race Conditions, The critical-section problem, Peterson's solution, mutex locks, Synchronization Hardware, Semaphores and their Implementation, Classic problems of synchronization.

System Model, Deadlock characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock

Unit II [20 Hrs]

Memory Management background**,** Swapping , Contiguous Memory Allocation, Paging, Segmentation

Introduction to Virtual-Memory, Demand Paging, Process creation, Page replacement, Allocation of frames, Thrashing

File Concept, Access Methods, Directory Structure, File-system mounting, File sharing, Protection.

Basic model of real time systems, Characteristics, Applications of real time systems, Real time task scheduling, handling resource sharing, Micro kernel design, Processes and Threads, Memory Management, File system. Failure Recovery and Fault Tolerance, Approaches of fault tolerance

Unit III: [10 Hrs]

Introduction to TCP/IP, Benefits of using TCP/IP,IP addressing, IP Network and Host addressing, Classfull and classless IP addresses, IPV6, Subnet mask, Subnetting and supernetting

Switch fundamentals (Bridges vs. Switches) – Spanning Tree Protocol, Rapid Spanning Tree protocol.

Unit IV [10Hrs]

VLAN- concepts, broadcast domains with VLANs and routers, preventing broadcast storms. VLAN Trunking Protocol, VTP modes of operation, Routing between VLANs, Inter-VLAN routing issues.

Static V/s Dynamic routes, Adding and deleting static routes, Routing protocol, RIP, OSPF, IGP, Secure IP routing.

References:

Mandatory:

1. Silberschatz ,Galvin and Gagne , Operating systems Principles – 8th edition Wiley Asia Student Edition.
2. Singhal, M. &Shivaratri, N.G (2000), *Advanced concepts in operating systems.* Delhi, India: McGraw-Hill.
2. Beasley, J S. &Nilkaew, P. (2015), *A practical guide to advanced networking*, Chennai, India: Pearson.

Supplementary:

1. Stallings, W.(2009), *Wireless communications and networks,* (2nd Ed), New Delhi, India: Prentice Hall of India.
2. Deitel H.M., “An Introduction to Operating Systems”, Addison Wesley Publishers Company, Second Edition, 1990.
3. Milenkovic M., “Operating Systems : Concepts and Design”, McGraw Hill International Edition Computer Science series ; Second Edition, 2001.

4. Tanenbaum A. S., Modern Operating Systems", Prentice Hall of India Pvt. Ltd.,Third Edition, 2015.

Web Resources:

1. https://swayam.gov.in/nd1_noc20_cs16/preview
2. https://swayam.gov.in/nd1_noc20_cs23/preview
3. http://study-ccna.com/

Course Title: Machine Learning
Course Code: PGPM-IT-DSC-403
Credits: 4
Marks: 100
Duration: 60 Hrs

Course Prerequisites:
- Familiarity with Probability & Statistics.

Course Objectives:
- Provide a broad introduction to artificial intelligence and machine learning techniques.

Course LearningOutcomes:
At the end of the course students will be able to:

CLO1: Design and Implement Machine Learning solutions to real-world problems.
CLO2: Evaluate and interpret the result of Machine Learning Algorithms.
CLO3: Recognize various ways of selecting suitable model parameters for different machine learning techniques.
CLO4: Perform experiments in Machine Learning using real-world data.

Syllabus:

Unit I Introduction [15 Hrs]

What is Artificial Intelligence, Machine Learning & Deep Learning, Problems spaces & search, Heuristic search techniques, Knowledge Representation Issues, Predicate Logic, Representing knowledge using Rules.

Unit II Supervised Learning [15Hrs]
Supervised learning setup, LMS, Logistic regression, Decision Trees, Version space, Artificial Neural Networks, Perceptron, Back propagation neural network, Exponential family, Generative learning algorithms, Gaussian discriminant analysis. Naive Bayes, Support vector machines, Model selection and feature selection, Ensemble methods: Bagging, boosting, Evaluating and debugging learning algorithms.

Unit III Unsupervised Learning [15 Hrs]
Clustering. K-means, Hierarchical clustering, EM. Mixture of Gaussians, Factor analysis, Anomaly detection, PCA (Principal components analysis), ICA (Independent components analysis), Self-organizing map(SOM).

Unit IV Reinforcement Learning [15 Hrs]
Introduction, Upper Confidence Bound Bandit Algorithm, Probably Approximately Correct Bandit Algorithm, Median Elimination, Policy Gradient, Full RL and MDPs. Bellman equations, Value iteration and policy iteration, Dynamic Programming and Temporal Difference Methods

References:

Mandatory:

1. Alpaydin E (2015), *Introduction to Machine Learning* (3rd Ed), New Delhi, India: PHI Learning Pvt. Ltd.

Supplementary:

1. Mitchell T (2017), *Machine Learning* (1st Ed), New Delhi, India: McGraw HillEducation.
2. Duda R, Hart P & Stork D (2012), *Pattern Classification* (2nd Ed), New Delhi, India:Wiley
3. Rich E, Knight K & Nair S (2017), *Artificial Intelligence* (3rd Ed), New Delhi, India: McGraw-HillEducation.
4. R. S. Sutton and A. G. Barto. Reinforcement Learning - An Introduction. MIT Press.

Web References:

1. https://nptel.ac.in/courses/106106139/
2. https://nptel.ac.in/courses/106/106/106106202/
3. https://nptel.ac.in/courses/106/106/106106198/
4. https://nptel.ac.in/courses/106106143/
5. https://www.coursera.org/learn/machine-learning

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Course Title: AdvancedData Structures and Algorithms Lab
Course Code: PGPM-IT-DSC-404
Credits: 2
Marks: 50
Duration: 60 Hrs

Course Prerequisites:
Theoretical Knowledge of Data Structures

Course Objective:
● Introduce students to a number of highly efficient algorithms and data structures for fundamental computational problems across a variety of areas.
● Analyze a problem and determine the appropriate data structure for the problem.
● Analyze the asymptotic performance of algorithms .

Course Learning Outcomes:
At the end of the course students will be able to:

CLO1: Select algorithm design approaches in a problem specific manner.
CLO2: Become proficient in applying knowledge from the theory of Data Structures to various application areas.
CLO3: Design Algorithms to solve the problems.
CLO4: Discuss different Data Structures to represent real world problems.

List of suggested assignments:
1. Implementation of Linear Data Structure such as Stack, Queue, Linked List etc**.** **[6 Hrs]**
2. Implementation of Binary Tree and its Traversals. **[6 Hrs]**
3. Implementation of AVL Tree. **[6 Hrs]**
4. Implementation of Red Black tree. **[6 Hrs]**
5. Implementation of Heap Structure **[6 Hrs]**
6. Implementation of Graph Traversal Techniques (BFS and DFS). **[6 Hrs]**
7. Implementation of Sorting Techniques (Quick Sort and Merge Sort) **[6 Hrs]**
8. Implementation of Hashing: linear probing, quadratic hashing and Double hashing. **[8 Hrs]**
9. Implementation of Simple Trie. **[6 Hrs]**
10. Implementation of Huffman Algorithm. **[4 Hrs]**

***Mini Project on Application of Data Structures**

Course Title: Operating Systems and Networks Lab
Course Code: PGPM-IT-DSC-405
Credits: 2
Marks: 50
Duration: 60 Hrs.

Course Prerequisites:
- Theoretical Knowledge of operating systems and networks.

Course Objectives:
- To provide practical base in operating system and networks.

Course LearningOutcomes:
At the end of the course students will be able to:

CLO1: Manage processes, memory and file system using system calls.
CLO2: Illustrate socket communication involving sender process and receiver process using TCP and UDP.
CLO3: Analyse network traffic by using network analyser tool.
CLO4: Design and demonstrate VLANs by using simulation tool.

Syllabus:

1. Linux File System, File & Directory Management.	**[12 Hrs]**
2. Filters	**[6 Hrs]**
3. Process Management	**[4Hrs]**
4. Shell Scripting	**[6 Hrs]**
5. TCP client and server application	**[4Hrs]**
6. UDP client and server application	**[4Hrs]**
7. Using nmap for port scanning and vulnerability detection.	**[4Hrs]**
8. Configuration of a Firewall.	**[4Hrs]**
9. Using ethereal or tcp dump to analyse network traffic.	**[4Hrs]**
10. Creating subnets and supernets using simulation tools.	**[4Hrs]**
11. Configuring static and dynamic route using routing tools.	**[4Hrs]**
12. Configuring VLANs.	**[4Hrs]**

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Course Title: Design and Analysis of Algorithms
Course Code: PGPM-IT-DSC-406
Credits: 4
Marks: 100
Duration: 60 Hrs

Course Prerequisites: Understanding of basic Data Structures, Recursion, Matrix operations, Proof byInduction

Course Objectives:
- Understand the basic concepts related to the design and analysis of algorithms
- Understand classical algorithms and their complexity
- Apply the algorithms to real-world problems

Course Learning Outcomes:
At the end of the course students will be able to:

CLO1: Analyze the running time of various algorithms.
CLO2: Apply the algorithms and techniques to solve various problems.
CLO3: Analyze the complexities of various problems in different domains.
CLO4: Design their own algorithmic strategies to solve problems and analyze their correctness.

Syllabus:

Unit I: Foundations for Design and Analysis of Algorithms [20 Hrs]

Introduction: The Role of Algorithm in computing, Framework for design and analysis of algorithms,Growth of functions: asymptotic notation; Recurrences: substitution method, recursion-tree method,master method; Probabilistic analysis and randomized algorithms, indicator random variables.

Dynamic programming: Rod-cutting problem.Assembly line scheduling, matrix-chain multiplication, elements of DP, longest common subsequence, Optimal BST.

Unit II: Advanced Design and Analysis Techniques [15 Hrs]

Greedy algorithms: Elements of greedy strategy, Huffman codes, Optimal storage on tapes,Minimum Cost spanning tree- Kruskal and Prim's algorithms, performance analysis.

Backtracking: The general method,8 Queens problem , sum of subsets,Graph coloring.

Branch-and-Bound: The method, 0/1 Knapsack problem
Amortized analysis: Aggregate analysis, accounting method, potential method, dynamic tables.

Unit III: Graph and Text Processing Algorithms [15 Hrs]

Graph Algorithms: Elementary graph algorithms- Minimum spanning tree: growing a spanning tree,
Single-source shortest paths: Bellman-ford algorithm, Djikstra's algorithm. All pairs shortest paths:shortest paths and matrix multiplication, Floyd-Warshall algorithm.

Text Processing Algorithms: Strings and patterns matching algorithms, Naive Brute Force, Rabin-Karp,KMP Algorithms,Tries, Text compression. Text Similarity testing.

Unit IV: NP Completeness and Approximation Algorithms [10 Hrs]

NP-Completeness: Polynomial time, polynomial time verification, NP-completeness and reducibility.

Approximation algorithms: The vertex cover problem, Traveling salesman problem, the set covering problem.

References

Mandatory:
1. Cormen, T. H., Leisorson, C. E., Rivest, R. L.& Stein, C., (2010), Introduction to algorithms, (3rd ed), New Delhi, India: PHI, Eastern Economy Edition

Supplementary:
1. Knuth, D. E. (2011), The art of computer programming Vol I, II, III, Boston, United States: AddisonWesley
2. Horowitz, E., Sahni, S., Rajasekaran, S. (2008), Fundamentals of computer algorithm (2nd ed), NewDelhi, India: Galgotia Publications
3. Aho, A., Hopcroft, J., Ullman, J. (2004),The design and analysis of computer algorithms, New Delhi,India: Pearson Education, LPE
4. Gilberg, R., Forouzan, B. (2004).Data Structure: a pseudo code approach with C, USA: ThomasLearning Inc.

Web Resources:
1. https://nptel.ac.in/courses/106106131/
2. https://www.geeksforgeeks.org/fundamentals-of-algorithms/
3. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-006-introduction-to-algorithms-fall-2011/
4. https://www.udemy.com/course/introduction-to-algorithms-and-data-structures-in-c

Course Title: Advanced Database Management Systems
Course Code: PGPM-IT-DSC-407
Credits: 4
Marks: 100
Duration: 60 Hrs

Course Prerequisites:
Fundamental knowledge of Database Management Systems

Course Objectives:
- Understand the concept of a database transaction and related database facilities.
- Introduce research development ability in databases through technical survey and Presentation.

Course Learning Outcomes:
At the end of the course students will be able to:

CLO1: Understand methods of storing, managing and interrogating complex data with cost estimation on execution of query based on DB statistics.
CLO2: Analyze the background processes involved in optimizing queries and transactions.
CLO3: Develop a high-level understanding of major Distributed DBMS components and their function.
CLO4: Define, compare and use the two types of NoSQL Databases (Document-oriented, Graph).

Syllabus:

Unit I: [15 Hrs]
Database Design and Query Processing
Database Schemas, SQL Commands, Constraints, Keys in ADBMS, SQL Queries: Simple, Complex, Nested queries and its functions. Advanced SQL Queries: Overview of Assertions, Triggers, Comparisons, Views as Virtual Tables, Roles and Privileges, Stored Procedures.

Database Design Theory, Functional Dependencies, Normalisation Design, Decomposition of relational schemes, Normal forms for Relations, schemas, Multivalued and other forms of Dependencies. Basic algorithms for executing query operations, Query Processing and Optimisation, Basic optimization strategies, Algebraic manipulations, External Sorting, optimization of selections in system.

Unit II: [15 Hrs]
Database Concurrency and Recovery Techniques
Simple transaction model, serializability, lock based protocols, Timestamp based protocol, Concurrency Control, Deadlock handling (Wait-die, wound-wait, no waiting, cautious waiting), optimistic concurrency control. Recovery Concepts, NO-UNDO/REDO Recovery Based on deferred update, Recovery technique based on immediate update, Comparisons, shadow paging, ARIES Recovery Algorithm.

Unit III: [15 Hrs]
Distributed Database and Security

Principles of Distributed Databases, Fragmentation: Correctness rule of Fragmentation, Horizontal Fragmentation, Vertical Fragmentation, Hybrid Fragmentation, Framework for distribution, translation of global queries into fragment queries, query optimization and management of distributed transaction, concurrency control and reliability in distributed databases.
Database Security: Types of Security, Threats, Control Measures, SQL Injection, its risks and Protection techniques

Unit IV: Emerging Technologies [15 Hrs]

Emerging Technologies
XML Databases: XML-Related Technologies-XML Schema- XML Query Languages, Geographic Information Systems, Cloud Based Databases: Data Storage Systems on the Cloud , Introduction to Big Data-Storage-Analysis. Introduction of NoSQL databases: Document Database (MongoDb), GraphStores: Neo4j

References:

Mandatory:

1. Elmasri & Navathe(2016), Fundamentals of Database Systems,(7th Ed),Pearson Arlington.
2. Abraham Silberschatz, Henry F. Korth(2016), Database System Concepts,(6th Ed), McGraw Hill Pennsylvania.

Supplementary:

1. Rini Chakrabarti ,Shilbhadra Dasgupta(2011), Advanced Database Management System,
2 nd Ed) DreamtechPress,Kolkota India
2. S.Ceri and G.Relagatti(2017), Distributed Databases,(1st Ed),McGraw Hill Education India Private Limited New Delhi,

Web References:

1: https://link.springer.com/10.1007%2F978-0-387-39940-9_712
2: http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.71.1311&rep=rep1&type=pdf
3: https://rubygarage.org/blog/neo4j-database-guide-with-use-cases
4: http://datasys.cs.iit.edu/events/ScienceCloud2013/p02.pdf

Course Title: Software Architecture, Design Patterns and Frameworks
Course Code: PGPM-IT-DSC-408
Credits: 2
Marks: 50
Duration: 30 Hrs.

Course Prerequisites:

- Familiarity with requirement elicitation techniques and knowledge of basics of software design, programming and testing

Course Objectives:

- Learning Software Development using good OO Design and Architecture
- Understanding of Design and Architectural patterns and Frameworks.

Course Learning Outcomes:

At the end of the course students will be able to:

CLO1: Apply various concepts of Object-Oriented Analysis and Design while solving problems.
CLO2: Analyze a problem scenario and prepare various models of the solution.
CLO3: Analyze a given problem and study the applicability of Design Patterns to the problem.
CLO4: Generate code skeletons in an OO programming language from UML class diagrams.

Syllabus:

Unit I **[15 Hrs]**

Encapsulation, Abstraction, Implementation Hiding, Inheritance, Dynamic binding, Polymorphism, Overriding and Overloading, SOLID Principles of Object-Oriented Design. Scenarios, Actors & Use Cases, The include and extend relationships, Use Case Generalization, Writing Use Cases formally, Choosing System Boundary, Finding Actors and Use cases, Using use cases for Verification and Validation, Use-Case Realization Classes, Objects, Attributes and Operations, Visibility of attributes and operations, Class-Scope Attributes, Attributes with default values, Association, Multiplicity, Role-Name, Qualified Association, Association Class**,** Ternary Association, Recursive Association, Multiple Association between two classes, Composite and Shared Aggregation, Generalization and sub-class partitioning, Generalization Set, Interfaces and their realization, Packages and Grouping of classes into Packages , Parameterized Classes. Modelling object interaction using Interaction Diagrams.

Unit II **[15 Hrs]**

Modelling the behaviour of reactive objects using State chart diagrams; Modelling systems workflows or operations using Activity diagram. "GoF" patterns & AntiPatterns, Software Architecture & its importance, System Quality attributes discernible at runtime, Business Qualities, Architecture Qualities, Data Flow Architecture, Virtual machine Architecture, Call & Return Architecture, Independent Component Architecture. MVC & Broker, Component and Deployment Diagrams.

References:

Mandatory:

1. Erich Gamma, Richard Helm, Ralph Johnson, John Vlissides, Design Patterns: Elements of Reusable Object-Oriented Software, Pearson Education, First Edition.

Supplementary:

1. Bass L, Clements P & Kazman R (2019), *Software Architecture in Practice* (3rd Ed),Westford, USA: PearsonEducation.

2. Buchmann F, Munier R,RohnertH, Sommerland P & Stahl M (2008), *Pattern Oriented Software Architecture-I* (First Ed),Wiley.

Web References:

1. https://www.coursera.org/learn/object-oriented-design
2. https://cosmolearning.org/courses/software-architecture-design/video-lectures/
3. https://swayam.gov.in/nd1_noc19_cs69/

Course Title: Design and Analysis of Algorithms Lab
Course Code: PGPM-IT-DSC-409
Credit : 2
Marks: 50
Duration: 60 Hours

Course Prerequisites: Theoretical knowledge of Design and Analysis of Algorithms

Course Objectives: Understand the various algorithm design approach

Course Learning Outcomes:
At the end of the course students will be able to:
CLO1: Implement various algorithms using dynamic programming approach.
CLO2: Implement various Internet algorithms.
CLO3: Implement various graph Algorithms.
CLO4: Implement algorithms for real life problems

List of suggested assignments:

1. **Implementation of Elementary Data Structures [10 Hrs]**
   a. Stacks, Queues Linked List applications
   b. Hashing
   c. AVL Trees
   d. Red Black Trees

2. **Implementation of various Graph algorithms. [08 Hrs]**
   a. Djikstra's Algorithm
   b. Bellman Ford Algorithm
   c. Floyd Warshall Algorithm

3. Implementation of various Text Processing Algorithms [10 Hrs]
   a. Tries
   b. Text Compression
   c. Pattern Matcher

4. Implementation of algorithms using Dynamic Approach [08 Hrs]
   a. Matrix Chain Multiplication
   b. Longest Common Subsequence

5. Implementation of algorithms using Greedy Approach [06 Hrs]
   a. Optimal Storage on Tapes
   b. Minimum Cost Spanning Tree

6. Implementation of Backtracking approach for various problems. [08 Hrs]
   a. 8-Queen's Problem
   b. Graph Coloring

7. Implementation of Text Processing Algorithms [08 Hrs]
   a. Rabin-Karp Algorithm
   b. KMP Algorithm

Course Title: Advanced Database Management Systems Lab
Course Code: PGPM-IT-DSC-410
Credits:2
Marks: 50
Duration: 60 Hrs

Course Prerequisites:
Theoretical knowledge of Advanced Database Management Systems

Course Objectives:
- Understand the concept of a database transaction
- To understand Schema representation methods in Relational and NO SQL Databases

Course Outcomes:
At the end of the course students will be able to:

CLO1: Populate and query a database using SQL,DML/DDL commands.
CLO2: Execute various advance SQL queries related to Transaction Processing & Locking using concept of Concurrency control, assertions, triggers and stored procedures.
CLO3: Execute CRUD and various other queries operations using NOSQL database: MongoDB
CLO4: Represent the database GraphStore database.

List of suggested Assignments:

1: SQL Queries : Simple, Complex and Nested Queries	**[09 Hrs]**
2: Views, Roles and Grants	**[09 Hrs]**
3: Advanced SQL- Joins and Triggers	**[06 Hrs]**
4: Advanced SQL- Stored Procedures	**[06 Hrs]**
5: Introduction to NO SQL database and Installation: MongoDB	**[03 Hrs]**
6: Creating Documents, Collection, inserting records, embedding documents	**[06 Hrs]**
7: Querying the documents and Linking	**[09 Hrs]**
8: Aggregation Framework and Map Reduce	**[09 Hrs]**
9: Installation and Introduction to GraphStore : Neo4j	**[03 Hrs]**

Course Title: Software Architecture, Design Patterns and Frameworks Lab
Course Code: PGPM-IT-DSC-411
Credits: 2
Marks: 50
Duration: 60 Hrs.

Course Prerequisites: Theoretical knowledge of Object-oriented concepts, design patterns and frameworks

Course Objectives:

- Implement the various concepts of Object Orientation.
- Implement the various Design Patterns.
- Usage of a framework.

Course Learning Outcomes:
At the end of the course students will be able to:

CLO1: Implement the various concepts of Object-Oriented Programming.
CLO2: Illustrate Creational, Structural and Behavioural Design Patterns.
CLO3: Analyze a given problem and apply Design Patterns to it solve problems by using a framework.
CLO4: Work with a framework.

1. Implementation of different concepts of Object Orientation i.e. Encapsulation, Abstraction, Implementation Hiding, Inheritance, Dynamic binding, Method Overriding and Method Overloading, Polymorphism **[6 Hrs]**
2. Implementation of S.O.L.I.D principles of Object-Orientation **[6 Hrs]**
3. Implementation of the Singleton and Factory patterns **[4 Hrs]**
4. Implementation of Abstract Factory, Builder and Prototype patterns **[6 Hrs]**
5. Implementation of Adapter, Bridge and Composite patterns **[6 Hrs]**
6. Implementation of Decorator and Proxy patterns **[4 Hrs]**
7. Implementation of Strategy, State and Observer patterns **[5 Hrs]**
8. Demonstration of Visitor, Chain of Responsibility and Memento Patterns **[5 Hrs]**
9. Experiments on Object-Relational Mapping framework to generate tables from classes, save objects and retrieve persisted objects **[6 Hrs]**
10. Experiments on Object-Relational Mapping framework to demonstrate saving of embedded objects, configuring columns of embedded objects, saving multiple embedded objects, saving collection of objects **[6 Hrs]**
11. Experiments on Object-Relational Mapping framework to demonstrate mappings, single table inheritance, table per class inheritance, table per subclass inheritance and CRUD operations. **[6 Hrs]**

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DISCIPLINE SPECIFIC ELECTIVES (DSE) - I

Course Title: Cloud Computing
Course Code: PGPM-IT-DSE-401
Credits: 4
Marks: 100
Duration: 60 Hrs

Course Prerequisite:
Computer Networks

Course Objectives:

- To understand the concepts of Cloud Computing.
- To learn Taxonomy of Virtualization Techniques.
- To learn Cloud Computing Architecture.
- To acquire knowledge on Aneka Cloud Application Platform.
- To learn Industry Cloud Platforms.

Course Learning Outcomes:
At the end of the course, student will be able to :

CLO1: Know the fundamentals of cloud, cloud Architectures and types of services in cloud.
CLO2: Understand the concept of virtualization and various technological drivers and how this has enabled the development of Cloud Computing
CLO3: Understand scaling in software and network development, cloud security and disaster management
CLO4: Design different Applications in cloud and explore some important cloud computing driven commercial systems

Syllabus

Unit 1 **[15 hours]**
Introduction to Cloud: Cloud Computing at a Glance, the Vision of Cloud Computing, Defining a Cloud, A Closer Look, Cloud Computing Reference Model. Characteristics and Benefits, Challenges Ahead, Historical Developments.
Cloud Computing Fundamentals : Introduction, Definition and Motivation for Cloud Computing, 5-4-3 Principles of Cloud Computing, Cloud Ecosystem, Requirements for cloud services, Cloud Applications, Benefits and Drawbacks.
Cloud Computing Architecture : Introduction, Cloud Reference Model, Architecture, Network Connectivity in Cloud Computing, Managing the cloud, Migrating applications to the cloud, Cloud Deployment Models – Private cloud, Public cloud, community cloud, Hybrid cloud, comparisons on basis of characteristics, suitability, Issues, Benefits and drawbacks. Cloud Service Models – Introduction, Infrastructure as a Service, Platform as a Service, Software as a Service, other cloud service models.

Unit II **[15 Hrs]**
Technological Drivers for Cloud Computing :

Introduction to SOA and cloud **–** benefits, technologies, similarities and differences. ***Virtualisation*** **–** Approaches, Hypervisor and its role, Types of Virtualisation. Memory and Storage technologies, Network technologies.
Web 3.0 **–** Components, characteristics, convergence of cloud and web 3.0, Example – Connecting information : Facebook, Search Optimisation and Web Commerce : BestBuy.
Software Process Models for Cloud **–** Agile SDLC for Cloud Computing, How Cloud Meets Agile Process?, Advantages.
Operating Systems for Cloud **–** Role of OS in cloud computing, Features of Cloud OS, Cloud OS Requirements, Cloud Based OS. ***Application Environment*** **–** Need for ADE, Application Development Methodologies, Overview of Cloud Application Development Platforms – Windows Azure, Google App Engine, Force.com . Cloud Computing APIs – Rackspace, IBM, Intel.

Unit III **[15 Hrs]**
Software Development in Cloud : Introduction, Different Perspectives on Saas Development, New Challenges, CAS development using Paas Development
Network Development in Cloud : Overview of Data Center Environment, Networking and Transport Layer Issues in Data Centers,
Security in Cloud : Introduction, Security Aspects, Platform Related Security, Audit and Compliance

Unit IV **[15 Hrs]**
Industrial Platforms and New Developments
Cloud Platforms in Industry – Amazon Web Services, Google App Engine, Microsoft Azure.
Advanced Concepts – InterCloud, Mobile Cloud, Media Cloud, Green Cloud, Cloud Analytics.

REFERENCES :
Mandatory
1. K.ChandraSekaran, "Essentials of Cloud Computing, CRC Press"
2. Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi: "Mastering Cloud Computing, Foundations and Applications Programming"

Supplementary
1. George Reese, " Cloud Application Architectures, First Edition, O"Reilly"
2. Cloud Computing – web based Applications that change the way you work and collaborate Online – Micheal Miller.Pearson Education.

Web References :
1. https://onlinecourses.nptel.ac.in/noc21_cs14/preview
2. https://nptel.ac.in/courses/106105167
3. https://in.coursera.org/specializations/cloud-computing
4. https://www.javatpoint.com/web-services-in-cloud-computing

Course Title: Software Quality Assurance and Testing
Course Code:PGPM-IT-DSE-402
Credits: 4
Marks: 100
Duration:60 Hrs

Course Prerequisites:
Knowledge of analysis, design and programming

Course Objectives:
To provide a detailed study of testing software and automated tools.

Course Learning Outcomes:
At the end of the course students will be able to:

CLO1: Apply Software Testing process in relation to Software Development and Project Management.
CLO2: Create Test Strategies and plans, design test cases, prioritize and execute them.
CLO3: Identify the needs of software test automation, and define and develop a test tool to support test automation.
CLO4: Use software testing methods and modern software testing tools for their testing projects.

SYLLABUS:

Unit I: [15 Hrs]
Testing fundamentals Software testing, Levels of software testing, Test activities, Testing Life Cycle, TestOrganization, White Box testing, Basis Path Testing, Control Structure testing, Black BoxTesting,Equivalence Class Partitioning, Boundary Value Analysis, Cause-effect Graphing, Special cases.

Unit II: [15 Hrs]
Functional Testing Performance Testing, Stress testing, Configuration Testing, Security Testing, RecoveryTesting, Integration Testing, Regression Testing, Acceptance Testing.
Object oriented testing methods
Testing Methods at Class level – Interclass test case design- Testing for Specific Environment, architecture,and application - Testing patterns

Unit III: [15 Hrs]
Testing Processes Comparison of different techniques- Test Plan – Test case Design ProcedureSpecification – Test Case Execution and Analysis - Test Documentation - Reporting test results - Final test report Test Driven Development & Refactoring.

Unit IV: [15 Hrs]
Testing Web Application Testing concepts for web apps, Content Testing, User Interface Testing ,Component Level Testing, Navigation Testing, Configuration Testing , Security Testing – PerformanceTesting. Testing Tools Need for automated testing tools - Selection of testing tool – Tools used at various phases.

References

Mandatory:
1. Desikan S., Gopalswamy R. (2006). Software Testing : Principles and Practices, India:Pearson Education.

Supplementary:
1.Kit E. Software Testing in the Real World, United States: Addison-Wesley Publishing Co.
2.William E.Software Testing and Continuous Quality Improvement, Auerbach Publications.

Web References :
1. www.guru99.com/software-testing.html
2. 2. https://www.tutorialspoint.com/software_testing/index.htm
3. 3. https://www.javatpoint.com/software-testing-tutorial

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Course Title: Computer Graphics
Course Code: PGPM-IT-DSE-403
Credits: 4
Marks: 100
Duration: 60 Hrs

Course Prerequisites:
Knowledge of Data Structures and Algorithms

Course Objectives:
To understand the concepts of Graphic Algorithms, Geometrical transformations and Modeling

Course Learning Outcomes:
At the end of the course students will be able to :

CLO1: Comprehend and analyze the fundamentals of animation, underlying principles, and applications.
CLO2: Apply 3D Transformation on the object.
CLO3: Develop familiarity with key algorithms for modelling and rendering graphical data.
CLO4: Design interactive computer graphics programs using Babylon JS.

Syllabus:

Unit I: [15 Hrs]
Introduction to Computer Graphics and Graphics Transformation
History of Computer Graphics, graphics primitives, scan conversion. 2D Transformations, composite transformation, viewing transformation, clipping algorithms.

Unit II: [15 Hrs]
3D Transformation and Representation of Curve
Viewing pipeline, Parallel and Perspective projections, view volumes, clipping ,Parametric, curves, continuity conditions, cubic splines, Hermite interpolation, Bezier curves and surfaces, B-spline Curves, Fractals.

Unit III: [15 Hrs]
Visible Surface Detection and Rendering Algorithm
Regularized Boolean operators, Sweep methods, Boundary Methods Constructive solid geometry methods,representation through quad trees and Octrees. Issues in Visible surface determination Coherence, backface culling, Z-Buffer and A-Buffer Algorithms, use of Binary Space Partitioning trees, Boolean operations onOctrees, Visible surface ray tracing. Diffuse andSpecular illumination model, reflection vector computation, Shading models for polygons –polygon mesh shading, Gouraud and Phong Shading, problems with interpolated shading,
Transparency, shadows, Ray tracing.

Unit IV: [15 Hours]
Animation
Perception, Animation production, use in film and videos, orientation representation andInterpolation, Motion along a curve –computing are length, speed control – sine interpolation,

rigid body simulation, collision detection, Particle systems – particle generation, modeling water, fire, explosions.

References:

Mandatory:

1. Foley, Van Dam, Feiner, Hughes(2013), Computer Graphics – Principles and Practices (3 rd Ed), Pearson Education India New Delhi.

Supplementary:

1. Rick Parent(2012), "Computer Animation: Algorithms and Techniques(3rd Ed), Morgan-Kaufman California.
2. Hearn & Baker(2010), Computer Graphics with OpenGL(4th Ed), Prentice Hall of India Delhi.

Web References:

1: https://nptel.ac.in/courses/106106090/
2: http://cs.wellesley.edu/~cs110/lectures/M01-color/graphics.pdf
3: http://gamma.cs.unc.edu/graphicscourse/solid_modeling.pdf
4: https://link.springer.com/chapter/10.1007%2F978-3-642-77263-4_20

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Course Title: Compiler Design
Course Code: PGPM-IT-DSE-404
Credits: 4
Marks: 100
Duration: 60 Hrs
Course Prerequisites: None

Course Objectives:
To enable the student to understand compiler construction and equip them with skills to write a compiler for a programming language.

Course Learning Outcomes:
At the end of the course students will be able to:

CLO1: Convert a NFA to DFA and minimize the DFA.
CLO2: Perform Lexical Analysis using tools such as Lex and YACC.
CLO3: Apply the concepts of Register allocation.
CLO4: Design and code a simple compiler for a programming language.

Syllabus:
Unit I. Introduction and ContextFreeGrammars [15 Hrs]
Lexical analysis, Regular Expressions, Finite automata. N.F.A., N.F.A. to D.F.A. conversion, D.F.A., minimization of D.F.A., Lex tool, Derivations & Parse trees, Syntax analysis: Parsing, Top Down Parser, Recursive descent Parser, Predictive parsing, LL(1) Parsing table, Bottom UpParsing, Shift Reduce parsing, Operator precedence parsing, LR Parsing methods, SLR, LRDL,LALR, YACC tool.

Unit II Syntax Directed Translation, Error DetectionandRecovery [15 Hrs]
Syntax directed translation schemes, Implementation of syntax directed translation schemes, Intermediate codes, Post fix notation parse trees & syntax trees, three address codes, quadruples, triples, Translation of assignment statements, Boolean expression, statements that after flow of control, Post fix translation, Translation with Up down parsing. Errors, lexical phase errors, Syntactic phase errors, semantic errors.

Unit III Code Optimization and DataFlowAnalysis [15 Hrs]
Loop optimization, DAG representation of basic block, value numbers & algebraic laws, Globaldata flow analysis, Dominators, Reducible flow graph, Depth first search, Loop invariant computation, Induction variable elimination, Reaching definition, Available Expression, copy propagation, Backward flow problems, Very busy, expression & code hoisting code.

Unit IV Code Generation andRegisterAllocation [15 Hrs]
A simple code generation, code generation from DAG & labeled trees, Coloring by implication, coalescing, graph coloring implementation, Register allocation for Trees.

References:

Mandatory:
1. Aho A, Ullman J, Lam M & Sethi R (2006), Compilers - Principles, Techniques, and

Tools (2nd Ed), New Delhi, India: Pearson Education.

Supplementary:

1. Tremblay J & Sorenson P (2014), Theory & Practice of Compiler Writing (4th Ed), New Delhi, India: B. S.Publication

Web References:

- https://nptel.ac.in/courses/106105190/
- https://www.tutorialspoint.com/compiler_design/index.htm
- https://www.geeksforgeeks.org/compiler-design-tutorials/
- https://www.javatpoint.com/compiler-tutorial

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DISCIPLINE SPECIFIC ELECTIVES (DSE) - II

Course Title: Web Development Frameworks
Course Code: PGPM-IT-DSE-405
Credits: 2
Marks: 50
Duration: 30 Hours

Course Prerequisite: Object Oriented Paradigm, Basics of Web , PHP

Course Objectives:
Use Web Frameworks and Libraries to develop interactive web applications using both front end and back-end frameworks

Course Learning Outcomes:
At the end of the course, student will be able to :

CLO1: Build a web application using Laravel framework
CLO2: Use ReactJS to build rich and interactive front end applications.
CLO3: Use NodeJS to develop back end application to accept POST,GET,PUT,DELETE requests
CLO4: Develop REST API's using NodeJS and non blocking and blocking JS code.

Syllabus

Unit 1 **[15 Hrs]**

Laravel
Introduction to Laravel, Routing in Laravel, MVC in Laravel, Caching in Laravel, Event subscribers in Laravel, Package Development, Templates, Creating an Application, Testing in Laravel, Database Configuration, Helpers in Laravel, Laravel Pagination, Laravel Security, Authentication Facade, Validation in Laravel, Eloquent ORM, Artisan Command Line Interface, Deploy Application using Laravel.

ReactJS
History of front end libraries, Motivation for using React, Thinking in React, One way binding, JSX+ CSS modules, Virtual DOM, ES6
ReactJS:components
Component lifecycle, Component API, Render functions, State, Props, Mixins

Unit II **[15 Hrs]**

ReactJS:Interaction between components
Passing data from parent to child, Passing data from child to parent, Passing data between 2 components at the same level, Forms, Refs, React-Router, API integration
NodeJS: Express framework
Set up a web server, Implementing API routing, Implementing middle-ware, Implementing URL parameters.
NodeJS: MySQL module
Setting up a database and connect it to a NodeJS server, Storing and retrieving data from the database.

MERN STACK AND GIT
Introduction to MERN Stack and GIT.

Practical : 2 Credits **(60 Hours)**
Maximum Marks: 50

List of Lab Assignments:
1: Study of Laravel Framework: **[12 Hrs]**
a. Migrations in Laravel
b. Using Forms and Gathering Input in Laravel
c. Creating a registration & user login form in Laravel
d. Using Controllers and Routes for URLs and APIs in Laravel
e. Eloquent ORM in Laravel
f. Creating and Using Composer Packages
g. Security & Session
2: Creating a simple web server and connect to MYSQL database. **[06 Hrs]**
3: CRUD using MySQL database API's. **[08 Hrs]**
a. Fetch data from a form, validate and insert in the database.
b. Delete data in the database.
c. Update data in the database
d. Display data from the database.
4: Uploading files, Login Functionality using sessions **[04 hrs]**
5: Using Cookies to store website data **[04 Hrs]**
6: Create an unique app with react.js and node.js **[08 Hrs]**
7: Using sessions and OAuth to authorize and authenticate users in Node.js apps **[09 Hrs]**
8: Building Node.js REST API Servers with Express.js **[09 Hrs]**

Mini Project Mandatory where students will develop a web based or app based or web app based projects covering all the aspects of Web development frameworks covered in the syllabus

REFERENCES :

Mandatory
1. Stauffer, M. (2019). Laravel: Up & Running: A Framework for Building Modern PHP Apps. O'Reilly Media.
2. Brett McLaughlin (2011). What Is Node ? (1st ed) O'Reilly Media \
3. Alex Banks (2017). Learning React. (1st ed) Shroff / O'Reilly
Supplementary
1. Brinzarea, B., & Hendrix, A. (2009). Ajax and PHP: Building modern Web applications. Packt Publishing Ltd.
2. Mario Casciaro (2016). Node.js Design Patterns (2nd ed) Packt Publishing Limited
Web References :
1: https://laravel.com/docs/6.x
2: https://www.tutorialspoint.com/laravel/index.htm
3: https://nodejs.org/en/docs
4: https://legacy.reactjs.org/tutorial/tutorial.html
5: https://www.youtube.com/watch?v=Ke90Tje7VS0

Course Title: Mobile Application Development
Course Code: PGPM-IT-DSE-406
Credits: 2
Marks: 50
Duration: 30 Hours

Course Prerequisite: Basics of Javascript

Course Objectives:
- To facilitate students to understand android SDK
- To help students to gain a basic understanding of iOS application development

Course Learning Outcomes:

CLO1: Critique mobile applications on their design pros and cons
CLO2: Utilize rapid prototyping techniques to design and develop sophisticated mobile interfaces
CLO3: Program mobile applications for the Android and iOS operating system that use basic and advanced phone features
CLO4: Deploy applications to the marketplace for distribution.

Syllabus

Unit 1: [15 Hrs]
A brief history of Mobile, Types of mobile phone generations, The Mobile Ecosystem, Types of Mobile Applications, Mobile Information Architecture Android Versions, Features of Android, Android Architecture, Installing Android SDK Tools, Configuring Android in Eclipse IDE, Android Development Tools (ADT), Creating Android Virtual Devices (AVD)

Introduction to React Native: Advantages of using React Native, Differences between React Native and React, Setting up the development environment

Introduction to Node.js and NPM: Installing Expo CLI, Setting up Android/iOS development environment, Creating a React Native app
Understanding basic components like View, Text, Image, etc. Inline styles and stylesheets. Handling user input.

Unit 2: [15 Hrs]
Using text input fields, Handling touch events, Navigation in React Native

Understanding navigation concepts, Using React Navigation library, Working with APIs

Handling responses and errors, Parsing JSON data, Integrating third-party libraries

Popular libraries: React Native Elements, Redux, etc.Using native modules with React Native Debugging and testing

Using Chrome DevTools for debugging, Using React Native Debugger, Writing and running tests with Jest and Enzyme

Publishing the app, Preparing the app for release, Generating app bundles, Submitting the app to Google Play Store and Apple App Store

Practical : 2 Credits **(60 Hours)**
Maximum Marks: 50

List of suggested practicals

1. Setting up the Android/iOS development environment, Installing Node.js and NPM Installing Expo CLI [8 Hrs]
2. Creating a React Native app, Running the app on a simulator/emulator [8 Hrs]
3. Creating custom components, Styling components, Handling touch events [8 Hrs]
4. Creating navigation screens and stack, Working with APIs [8 Hrs]
5. HTTP requests using fetch API, Integrating third-party libraries [8 Hrs]
6. Installing and using React Native Elements, Redux, [8 Hrs]
7. Using Chrome DevTools for debugging, running tests with Jest and Enzyme [6 Hrs]
8. Publishing the app, Submitting to Google Play Store and Apple App Store [6 Hrs]

References:

Mandatory:

1. P. Akshat, N. Abhishek, React Native for Mobile Development: Harness the Power of React Native to Create Stunning iOS and Android Applications, Apress, 2019

Supplementary:

2. Reto Meier, Professional Android 4 Application Development, Wiley India, (Wrox), 2012
3. James C Sheusi, Android Application Development for Java Programmers, Cengage Learning, 2013

Web References

https://developer.apple.com/tutorials/app-dev-training/
https://designcode.io/tutorials/
https://reactnative.dev/docs/more-resources
https://reactnative.dev/docs/getting-started

Course Title: Agile Methodologies and DevOps
Course Code: PGPM-IT-DSE-407
Credits: 2
Marks: 50
Duration: 30 Hours

Course Prerequisites:

- Knowledge of programming

Course Objectives:

- Provide students with a theoretical as well as practical understanding of agile software development practices
- Apply these practices in teams to create high-quality software.
- Provide an introduction to DevOps

Course Learning Outcomes:

At the end of the course students will be able to:

CLO1: Understand, appreciate and apply Agile practices for Software development
CLO2: Apply Software Configuration Management concepts to change requests
CLO3: Perform Test-Driven Development while solving real-world software problems
CLO4: Integrate and automate the work of software development and IT operations

Syllabus:

Unit I **[15 Hrs]**
Understanding how traditional software development works and its problems, Role of Agile practices in the world of software development & Tools used, Requirement Analysis, Estimation techniques, Iteration, planning, Introduction to development practices: Test Driven Development & Pair Programming, Introduction to QA Practices: Fail Fast & Automated functional testing, Introduction to Continuous Integration

Unit II **[15 Hrs]**
Practicing TDD and pair programming as alternative to traditional documentation; Configuring Continuous Integration tools; Automated function testing in detail, Source Control, Iterative and incremental software development, Automated and scripted deployment strategies, Handling change requests.
What Is Devops , History of Devops, Devops definition, DevOps Main Objectives, DevOps and Software Development Life Cycle, Waterfall Model versus Agile Model

Practical : 2 Credits **(60 Hours)**
Maximum Marks: 50

List of Suggested Practicals
1. Installing and configuring MAVEN with Eclipse [4 Hrs]

2. Experiment using MAVEN to simplify build process.	[6 Hrs]
3. Experiment using MAVEN to provide uniform build system	[6 Hrs]
4. Install Jenkins and perform Unit tests	[6 Hrs]
5. Demonstration of Automated testing using Jenkins	[6 Hrs]
6. Demonstration of Code Analysis and Automated Deployment using Jenkins	[8 Hrs]
7. Demonstration of and reporting using Jenkins	[6 Hrs]
8. Demonstration of distributed builds using Jenkins	[6 Hrs]
9. Demonstration of Version Control using GIT.	[6 Hrs]
10. Usage of GIT on remote repository platform	[6 Hrs]

References:

Mandatory:

1. Ken Schwaber & Mike Beedle Agile Software Development with Scrum, Prentice Hall, 2002.

Supplementary:

1. Mike Cohn, Agile Estimating and Planning, Prentice Hall, Professional Technical Reference, 2006.

Web References:

1. https://www.javatpoint.com/devops
2. https://www.guru99.com/devops-tutorial.html
3. https://www.tutorialspoint.com/devops_tutorials.htm

Course Title: Cryptography and Network Security
Course Code: PGPM-IT-DSE-408
Credits: 2
Marks: 100
Duration: 30 Hours

Course Prerequisite:
Computer Networks

Course Objectives:
To understand the principles of encryption algorithms, conventional and public key cryptography. To have a detailed knowledge about authentication, hash functions and application level security mechanisms.

Course Learning Outcomes:
At the end of the course, student will be able to :

CLO1: To know the methods of conventional encryption and concepts of Number theory
CLO2: To understand various authentication and hash functions in practice
CLO3: Understand and analyse various network security tools and applications
CLO4: Analyse the different system level security issues

Syllabus

Unit 1 **[15 Hrs]**
Symmetric Ciphers
Introduction, Services, mechanisms and attacks, The OSI Security Architecture, Security Attacks, Services, Security Mechanism, Model for Network Security.
Classical Encryption Techniques: Symmetric Cipher Model, Substitution Techniques, Transposition Techniques.
Block Ciphers and Data Encryption Standard : Simplified DES, Example, Strength of DES, Block Cipher Principles, The Data Encryption Standard, Multiple Encryption and Triple DES.

Public Key Encryption and Hash Functions
Introduction to Number Theory: Prime Numbers, Fermat's and Euler's Theorems, Testing for Primality, Euclid's Algorithm, Modular Arithematic, Chinese Remainder Theorem, Discrete Algorithms.
Public Key Cryptography and RSA: Principles of Public Key Cryptosystems, The RSA Algorithm
Advanced Encryption Standard: AES Structure, Functions, Key Expansion
Key Management : Key Management, Deffie-Hellman Key Exchange, Elgamal Cryptographic System.
Message Authentication and Hash Functions: Authentication Requirements, Authentication Functions, Message Authentication Codes (MAC).
Hash Algorithms : Hash Functions , Requirements and Security, Secure Hash Algorithm, SHA – 3

Unit II **[15 Hrs]**
Data Integrity and Network Security

Digital Signatures and Authentication Protocols: Digital Signatures, Elgamal Digital Signature Scheme, Schnorr Digital Signature Scheme.
Key Management and Distribution : Symmetric key distribution using Symmetric Encryption, Symmetric key distribution using Asymmetric Encryption, Distribution of Public Keys, X.509 Certificates, Public Key Infrastructure.
Network Access Control and Cloud Security: Network Access Control, Cloud Security, Risks and its countermeasures, Data Protection in the cloud

Internet Security

IP Security :Overview, Policy, Security Payload, Internet key exchange, Cryptographic suites.
Electronic Mail Security : Architecture, Formats, Threats and Security, S/MIME, PGP, Domain Based Message Authentication, Reporting and Conformance.
System Security : Intruders, Intrusion Detection , Password Management, Malicious Software : Viruses and related threats Virus counter measures, Firewalls: Firewall Design Principles , Trusted Systems.

Practical : 2 Credits **(60 Hours)**
Maximum Marks: 50

List of suggested Assignments:

1: Implementation of Classical Encryption Techniques as Substitution techniques: **[12 Hrs]**
   a. Caesar Cipher
   b. Monoalphabetic Cipher
   c. Playfair Cipher
   d. Hill Cipher
   e. Polyalphabetic cipher techniques
   f. One Time Pad
2: Implementation of Classical Encryption Techniques as Transposition techniques **[05 Hrs]**
3: Implementation of Simplified DES (S- DES) Algorithm **[06 Hrs]**
4: Implementation of Multiple Encryption on DES: **[06 Hrs]**
   a. Double DES
   b. Triple DES
5: Perform Encryption and Decryption using RSA Algorithm **[08 Hrs]**
6: Perform Encryption and Decryption using AES Algorithm **[08 Hrs]**
7: Implement the Diffie-Hellman Key Exchange mechanism using HTML and JS **[09 Hrs]**
8: Configure IP security and firewalls **[06 Hrs]**

Mini Project Mandatory where students will develop projects based on encryption and decryption methodologies with using proper HTML, JS and other web based applications

REFERENCES :

Mandatory

1. Cryptography and Network security 7th ed. William Stallings PEA.
2. Internet Cryptography by Richard E Smith, Pearson Education Asia, ISBN:81-297-0351- 3

Supplementary

1.Building Internet Firewalls by Chapman D., E. Zwicky, O'Reilly 1995, ISBN:81-7366- 101-4

2. Network Security Essential: Applications and Standards by William Stallings, PEA, ISBN:81-7808-307-8
3. Network Security, Private Communication in a Public World by Charlie Kaufman, Radia Perlman, Mike Speciner PTR Prentice Hall, 1995, ISBN:978-81-203-2213-4

Web References :

1: https://nptel.ac.in/courses/106/105/106105031/
2: https://engineering.purdue.edu/kak/compsec/NewLectures/Lecture8.pdf
3: https://www.us-cert.gov/ncas/tips/ST04-018
4: http://www.iet.unipi.it/g.dini/Teaching/sanna/lecturenotes/applied-cryptography-digital-signature.pdf
5: http://www.cs.man.ac.uk/~banach/COMP61411.Info/CourseSlides/Wk4.2.MAC.pdf

Annexure D

PROPOSED STRUCTURE FOR SYBVoc

(To be offered to Students taking admission to 2nd Year BVoc from Academic Year 2023-24 Onwards)

	Semester		Course	Credits	Marks
Level -6 Skill Development Qualification Pack – **Application Developer - Web & Mobile** **(SSC/Q 8403)**	3	APPLICATION DEVELOPER WEB & MOBILE	Object Oriented Programming Using Java	6	150
			Computer Networks	6	150
			Server Side Programming	6	150
		GENERAL	Reasoning Technique *	4	100
			E-Commerce	4	100
			Mathematical foundation of Computer Science*	2	50
			Internship	2	50
			TOTAL	30	750
	4	APPLICATION DEVELOPER WEB & MOBILE	Software Engineering	6	150
			Web Development Framework	6	150
			Mobile Application Development	6	150
		GENERAL	Personality Development	4	100
			Creative Thinking*	2	50
			Advance Quantitative Technique*	4	100
			Internship	2	50
			Total	30	750

*New courses are introduced in the course structure.

Summary Of Changes Incorporated In The Syllabus

Semester	Course title	Existing (indicate only the unit where the change is proposed)	Changes Proposed/new courses introduced	Specify the reason for the change
III	Reasoning Technique (General Component)	All the units	Syllabus Attached	EVS was already covered in the 1st Semester hence a addition of new Title was needed as per the NASSCOM Qualification pack **(SSC/Q8403)**
III	Mathematical foundation of Computer Science (General Component)	All the units	Syllabus Attached	This Title is reintroduced as there was a need for mathematical foundation for further topics in the later Semesters needed as per the NASSCOM Qualification pack **(SSC/Q8403)**
IV	Creative Thinking (General Component)	All the units	Syllabus Attached	Business Communication was already covered in the 1st Semester hence a addition of new Title was needed as per the NASSCOM Qualification pack **(SSC/Q8403)**
IV	Advance Quantitative Technique (General Component)	All the units	Syllabus Attached	This Title was added as per the NASSCOM Qualification pack **(SSC/Q8403)**

Course Title: Reasoning Techniques
Course Code: SD-G20
Credits: **4**
Marks: 100
Duration: 60

Prerequisite Courses : NIL

Course Objective

- To build logical and reasoning aptitude that is essential requirement in understanding various concepts and to solve problems effectively.

Course Learning Outcomes:
On successful completion of the course the students will

CLO1 : Create, solve and interpret basic data and logical models.

CLO2 : Make sound arguments based on reasoning and/or careful analysis of data.

CLO3 : Exhibit critical thinking by developing and expressing sound arguments from given premises to related conclusions

CLO4 : Effectively communicate the substance and meaning of logical problems and their solutions.

Syllabus:

Unit 1 **[15 hrs]**

Logic, Statements, Arguments, and Assumptions, Statements and Course of Action, Logical Venn Diagrams, Statements and Conclusions, Syllogism

Unit 2 **[15 hrs]**

Seating Arrangement, Ranking & Time Sequence Test, Blood Relations, Direction Sense Test, Conditions & Grouping, Simple & Coded Inequality, Decision Making, Clocks and Calendar, Situation Reaction Test

Unit 3 **[15 hrs]**

Decision-making, Judgment, Problem-solving, Analogies, Analysis, Differences, Discrimination Arithmetic series, Similarities, Verbal & figure classification, Space visualization, Observation Simple Problems on Data interpretation and Data sufficiency

Unit 4 **[15 hrs]**

Mathematical Logic: Introduction, Statements, Logical Connectives and Compound Statements: Negation, Conjunction, Disjunction, Implication, Converse and Inverse, logical Equivalence, Tautologies: Contradiction, Contingency, Algebra of Propositions, Argument, Predicate and Quantifiers.

REFERENCES

Mandatory Reading:

1. Arun Sharma, How to Prepare for Logical Reasoning for the CAT, 8th edition**,** McGraw Hill Education (India) Private Ltd.
2. A.K. Gupta, Logical and Analytical Reasoning, Ramesh Publishing House; 34th edition

3. Peeyush Bhardwaj, Analytical & Logical Reasoning for CAT & Other Management Entrance Tests, Arihant Publications; 4th edition
4. Rosen H. Kenneth, Discrete Mathematics and its Applications, Tata McGraw Hill, 7th edition

Supplementary Reading:

1. Ananta Ashisha, Data Interpretation & Data Sufficiency, Arihant Publications; Third edition
2. MK Pandey, Magical Book Series - Analytical Reasoning, BSC Publishing Co. Pvt. Ltd., 2017
3. Daniel kahneman, thinking fast and slow, Farrar, Straus and Giroux; Reprint edition
4. Dr. R.S. Aggarwal, A Modern Approach to Verbal & Non-Verbal Reasoning, 2018, S. Chand Publication

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Course Title: Mathematical Foundation of Computer Science
Course Code: SD-G21
Credits: 2
Marks:50
Duration : 30

Prerequisite Courses : NIL

Course Objectives:

- To build mathematical foundations that are essential requirements in understanding various concepts related to computer science.

Course Learning Outcomes:

CLO1: Gain knowledge in Propositions through the use of Logics.
CLO2: Demonstrate an understanding of relations and functions and determine their properties.
CLO3: Evaluate Boolean functions and simplify expressions using the properties of Boolean algebra.
CLO4: Write an argument using logical notation and determine if the argument is valid or not.

Syllabus:

Unit 1: **[15 Hrs]**

Binary Numerical Systems, Matrix Operations and Basic Sets

1. Binary Number Systems:

Introduction to Boolean Number System, Decimal to binary conversion and vice versa, binary number representation (signed, 1's Complement and 2's Complement), binary addition and subtraction, binary to octal, hexadecimal conversion and vice versa, floating point representation.

2. Linear Algebra:
Introduction to Matrices and Linear Algebra, Adjacent, Inverse of a Matrix, Rank, Linear Equations, Characteristics roots and vertices.

3. Basics of Sets, Relations and Functions:
Introductions to sets, relations and functions, Venn diagram, set operations, relations and properties, closures, equivalence relations, partial ordering, function types, inverse of functions, composition of functions, recursive functions, growth functions.

Unit 2: **[15 Hrs]**

Boolean Systems and Operations

1. Boolean Algebra:
Introduction to Boolean Algebra, boolean functions, truth table, DeMorgan's theorem, logic gates, realization of boolean functions using logic gates, simplification using Karnaugh map.

2. Logic:
What is logic, propositional logic, first order logic, mathematical induction, deduction, proof by contradiction, program correctness.

REFERENCES

Mandatory Reading:

1. Rosen H. Kenneth, Discrete Mathematics and its Applications, Tata McGraw Hill, Seventh Edition, 2011.

Supplementary Reading:

1. Sarkar Kumar Swapan, A Textbook of Discrete Mathematics, S Chand & Company, 2005.

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Course Title: Creative Thinking
Course Code: SD-G22
Credits: 2
Marks:50
Duration: 30

Prerequisite Courses : NIL

Course Objective

- This is a course on study of creative/lateral thinking and problem solving techniques those are essential to solve real world problems. Causal, deductive, and inductive arguments are described as well as the use of persuasion.

Course Learning Outcomes:
Upon completion of this course, students should be able to

CLO1: Identify the benefits of employing creative/lateral-thinking processes.

CLO2: Apply creative/lateral-thinking and problem-solving theories to real-world problems.

CLO3: Develop strategies to overcome the barriers that inhibit creative thinking.

CLO4: Identify strategies for creating an organizational culture that embraces and sustains creative-thinking practices

CLO5: Identify strategies to solve complex problems in a collaborative way.

CLO6: Apply creative/lateral-thinking principles to develop persuasive arguments that employ legal, moral, and aesthetic reasoning.

Syllabus

Unit 1 **[15 hrs]**

The way the mind works, Difference between lateral and vertical thinking, Attitudes towards lateral thinking, Basic nature of lateral thinking, The use of lateral thinking techniques, The generation of alternatives, Challenging assumptions, Innovation, Suspended judgment Design, Dominant ideas and crucial factors

Unit 2 **[15 hrs]**

Fractionation, The reversal method, Brainstorming Analogies, Choice of entry point and attention area, Random stimulation Concepts/divisions/polarization, The new word problem, Blocked by openness, Description/problem solving/design

REFERENCES

Mandatory Reading:

1. Edward De Bono, Lateral Thinking: Creativity Step by Step, Harper Perennial; Reissue edition (24 February 2015)
2. Ken Watanabe, Problem Solving 101: A simple book for smart people, Vermilion

Supplementary Reading:

1. R G Chaudhari, Training Techniques of Creative Problem Solving: Trainers Manual, Notion Press, Inc.; 1st edition
2. Mahon N, Basics Advertising 03: Ideation, AVA Publishing (October 26, 2011)
3. Brian Tracy, Creativity & Problem Solving: The Brian Tracy Success Library, Manjul Publishing House
4. Michael Sloan, The Art Of Problem Solving 101: Improve Your Critical Thinking And Decision Making Skills And Learn How To Solve Problems Creatively, Make Profits Easy LLC
5. Ruggiero, V. R., The art of thinking: A guide to critical and creative thought (11th ed.), Longman (2015).
6. Proctor, T., Creative Problem Solving for Managers: Developing Skills for Decision Making and Innovation, Routledge, 4th edition

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Course Title: Advanced Quantitative Techniques
Course Code: SD-G23

Credits: 4
Marks: 100
Duration: 60

Prerequisite Courses: NIL

Course Objective

- To build mathematical foundation that is essential requirement in understanding various concepts.
- To understand appropriate statistical techniques for grouping, displaying, analyzing and interpreting statistical data

Course Learning Outcomes:
On successful completion of the course, the students will be able to

CLO1: Understand the basic principles of sets and operations in sets.
CLO2: Apply counting principles to determine probabilities.
CLO3: Demonstrate an understanding of matrices and determinants
CLO4: Apply basic statistical concepts & techniques for quantification of data.
CLO5: Independently calculate basic statistical parameters (measures of central tendency and dispersion, correlation and regression coefficients, indexes)
CLO6: Interpret the meaning of the calculated statistical indicators based on the acquired knowledge

Syllabus

Unit 1 **[15 Hrs]**

Set, Relation, and Functions

SETS: Sets, Subsets, Equal Sets, Universal Sets, Finite and Infinite Sets, Operation of Sets, Union, Intersection and Complement of sets, Cartesian product, Cardinality of Sets, Simple Applications.

RELATION: Properties of Relation, Equivalence Relation

FUNCTIONS: Domain and Range, Onto , Into and One-to One- Functions, Composite and Inverse functions, Hashing functions and Recursive Functions, growth of functions

Unit 2 **[15 Hrs]**

Counting Principles

Permutations; Combinations; Counting; Probability Summation; Basics of recurrence relations

Matrices and Determinants

Definition, Minors, Cofactors, Properties of Determinants MATRICES: Definition, Types of matrices, Multiplication of matrices, Adjoint, Inverse, Cramer's Rule, Rank of matrix, Dependence of vectors, Eigen vectors of a matrix

Unit 3 **[15 Hrs]**

Statistical Sampling and Central Tendency

Collection, classification, tabulation and presentation of data; the concept and methods of sampling, sample types Measures of central tendency - mean, median, mode, quartiles, deciles and percentiles and their applications in data analyses

Unit 4 **[15 Hrs]**

Measures of Dispersion and Relation

Measures of Dispersion- Range - Quartile Deviation – Mean Deviation - Standard Deviation. Coefficient of Variation Meaning and use of correlation – Types of correlation-Karl Pearson's correlation coefficient – Spearman's Rank correlation. Calculation of Correlation; Regression analysis, comparison between correlation and Regression – Regression Equations, Interpretation of Regression Co-efficients

Note: *It is recommended to use excel/spreadsheets for Unit4 and Unit5*

REFERENCES

Mandatory Reading:

1. Rosen H. Kenneth, Discrete Mathematics and its Applications, Tata McGraw Hill, 7th edition
2. Gupta. S. C. Fundamental of Statistics, Himalaya Publishing House, Mumbai, 6th edition
3. Kolman, Busby, Ross, Discrete Mathematical structures, Pearson

Supplementary Reading:

1. Sarkar Kumar Swapan, A Textbook of Discrete Mathematics, S Chand & Company, 2005.
2. J.K. Sharma, Discrete Mathematics, Macmillan India Ltd., Second Edition – 2005
3. Spiegel. M. R. and Stephens. J. L., Shaum's Outlines Statistics, Tata McGraw-Hill, India, 2011
4. Sanchetti D.C and Kapoor V.K .Statistics - Theory, Methods and Application, Sultan Chand & Sons , New Delhi, 7th edition, 2010.

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